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The Agricultural Experiment Station

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REPORT OF THE ENTOMOLOGIST.

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and
AN ANNOTATED LIST OF COLORADO ORTHOPTERA.**

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BY

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Some of the More Important Insects of 1903.

By CLARENCE P. GILLETTE.

GRAIN BUG.

The Grain Bug (*Pentana sayi* Stal.*)

[Pl. I. Fig. H.]

Early in August complaints came to the Experiment Station of a large green bug that was doing extensive injuries to grain and other crops in Montezuma county. Mr. S. A. Johnson was sent to investigate the trouble. He went directly to Cortez and was greatly assisted in the work by Mr. P. S. Taylor of that place. The following is an extract from Mr. Johnson's report of what he found:

"Mr. Taylor took me to a number of fields of wheat and oats that had been injured by the green plant-bug." He says that the bugs appeared in great numbers in the fields of grain when they were just heading out where they accumulated upon the heads and seemed especially to suck the juices of the forming kernels. As the grain would reach maturity the bugs would migrate to other fields where the grain was not so far advanced. At present the attack is less severe, much of the grain having matured but still in most fields four or five strokes of an insect net will collect a handful of the bugs and many of the insects are upon the lower portions of the plants and upon the ground. The injuries in the grain fields are indicated by the presence of the blasted heads that have few or no kernels in them and which have ripened and turned white prematurely (see plate II. Fig. A.)

"The injury to oats was very severe. In some cases entire fields of grain appeared to be destroyed. Often the heads were blasted from the punctures of the bugs before they appeared above the leaf sheath.

"The insect seems to be a rather general feeder. It was reported upon first cutting of alfalfa, and upon sunflowers, sage and garden vegetables, especially peas. But very few were obtained

*Determined for us by Mr. E. P. VanDuzee; also by Mr. Otto Heldemann, through the kindness of Dr. L. O. Howard.

sweeping alfalfa with the net and it seemed probable that those taken in this manner might have come from the weeds. In case of peas and beans the pods were chiefly attacked and the juices were extracted from the seeds within. A peculiar effect upon the peas was that the punctures introduced or prepared a way of entrance for a fungus which soon rendered all the seeds unfit for use.

"No one remembered having seen the insect in injurious numbers before and some believed that the insect had migrated into their midst from farther down the river where it was reported that the bugs were still more abundant, and where they did some injury last year."

The following letter giving an estimate of injuries in Montezuma valley was written by Mr. P. S. Taylor, Oct. 21, 1903, in reply to my letter of inquiry:

"The bugs first appeared in the valley about the 20th of May, coming from the southwest for three days in succession. These lighted mostly on alfalfa fields where they deposited their eggs, which hatched about two weeks later.

"The bugs remained on the alfalfa until the first cutting of hay was made. Then, (about the first part of July) they left the hay fields going to adjoining wheat fields where for a time they sucked the sap from the wheat plants. As soon as grain formed in the heads the bugs bored into it, drawing their nourishment from the soft grain. This they continued until the wheat either hardened or was killed.

"Leaving the wheat they attacked oat fields in August, working in the same manner as on the wheat. But the damage that was done to oats was not nearly so great as that done to wheat.

"By the first of September nearly all the bugs had disappeared and so far as I could determine there were no eggs deposited after the first lot in June. The damage was done almost entirely in the lower part of the valley, on an area of 725 acres where an average yield for the past eight years was 35 bushels per acre, or a total of 25,375 bushels. The yield of the past season on the same number of acres was 15 bushels per acre, or a total of 10,875 bushels. This would show a shortage of 14,500 bushels and a money loss at present prices of over thirteen thousand dollars.

"Some fields of grain were entirely destroyed while others were injured only in spots."

Respectfully yours,
P. S. TAYLOR.

The following is an extract from a letter received from Mr. M. V. B. Page, of Fruita, Colo., dated August 6:

"I am sending you samples of a bug that is destroying crops of all kinds but more especially potatoes, by sucking the sap from the stems of the plants. They are upon oats as well. They come in patches and then spread over the fields. I first discovered them in a small patch of ten acres of early potatoes a week ago and now they are all over the patch. I find no small ones; all seem to be of the size of the sample sent."

This bug is a close relative of *Lioderma uhleri* which was reported by Saunders in Bulletin 57 of the South Dakota Experiment Station and the habits of the two insects seem much alike. The species that has been so abundant in the southwestern portion of Colorado the past summer is generally distributed over the mountainous portions of the State and has frequently been taken

from native plants for the College and Station collections. Mr. C. R. Jones, a special student in entomology here, found this bug common above timberline at Silverton, Colo., the past summer where he was collecting. Specimens are seldom taken at Fort Collins.

The insect is single brooded.

There was a great advantage this year in having grain ripen early. Fall wheat escaped the injuries almost entirely.

GRASSHOPPERS.

The destructive grasshoppers (locusts) which are usually very numerous over a great portion of the agricultural section of the State were comparatively few in number this year except in limited sections. The previous year was marked by unusually severe grasshopper depredations and the small number of these insects the present year is probably due to the prevalence last year of the native grasshopper disease, *Empusa grylli*. On the other hand, there has been very little of this disease among the grasshoppers the past summer and fall.

The Australian Grasshopper Fungus, was experimented with again this year. Several tubes of the fungus were sent directly from the Colonial Bacteriological Institute of the Cape of Good Hope through the kindness of the director, Dr. Alexander Edington. The cultures were received in an excellent condition and were used in the field and in our breeding cages but in no case were we successful in killing any of the grasshoppers as far as we could determine. As this is the second year that we have worked with this disease without obtaining any apparent results, I can see no reason to encourage Colorado farmers to hope for relief from grasshopper depredations through the use of the African grasshopper fungus (*Mucor sp.*)

A new grasshopper remedy known as "Criddle mixture" has been reported very efficient for the destruction of grasshoppers in Manitoba. It consists of a mixture of fresh horse manure, salt and Paris green which is distributed about the fields where the grasshoppers are numerous. In our experiments the ingredients were used in the following proportions:

Fresh horse manure	40 quarts.
Barrel salt	2 quarts.
Paris green	1 quart.

The preparation was repeatedly used in breeding cages and in field tests. In no case were the results very encouraging so long as there was green food obtainable. Poisoned alfalfa leaves and poisoned bran were used in comparison with the Criddle mixture and of the three the bran seemed most efficient. None of these preparations gave results that were very satisfactory.

Mr. Conrad Schaffer, an extensive and intelligent farmer living at Deuel, Colorado, decided to try the Criddle mixture and induced several of his neighbors to join with him and make a thorough test. In a verbal report to the writer on October 20, Mr. Schaffer said the mixture did but little good. He said he had much better results with a mixture of bran and Paris green that was moistened with just enough refuse syrup from a beet sugar factory to make the mixture adhere in small balls. These balls of poisoned bran were distributed about 20 feet apart along potato rows and in other places where the grasshoppers were abundant.

CUTWORMS.

The Army Cutworm (*Chorizagrotis auxiliaris*.*)

[Pl. I. Fig. A. B. C. D.]

which is usually as numerous as all other species put together in northern Colorado, occurred in more than its usual abundance last spring. The moths have a strong propensity for getting into buildings whether there are lights inside or not. It is a common thing for these moths to appear in large numbers upon the insides of windows during May and June. The moths also conceal themselves among the leaves of trees during the day time. The abundance of the moths was especially remarkable during the summer of 1902 and many inquiries were received at the Station concerning them. A stick or a stone thrown into a tree when they were most numerous would often cause hundreds to fly out for a few seconds then they would return. They were such an annoyance about lamps in houses that the occupants of the home would blow out the lights and go to bed just to get away from the nuisance. So that the unusual cutworm invasion of the past spring was only the sequel of the abundance of moths the preceding summer.

This is the species treated by Dr. Wilcox in Bulletin 17 of the Montana Experiment Station. It is a native of the Rocky Mountain region. I have found the moths not uncommon in this State, near to timber-line under the loose bark of stumps.

Specimens of the spring brood of moths have been taken at the Station between April 16 and July 10, and are usually most abundant about the first of June. The fall brood has been taken from September 13 to October 12. A queer circumstance in connection with my studies of this moth is, I have never been able to find fully developed ova in the females of the first brood though hundreds have been dissected and examined. In the great majority of cases there has been no indication of ova in any stage of develop-

**Chorizagrotis auxiliaris* having priority, I have included with it forms commonly determined as *introferens* and *agrestis* because in a larger series there seems to be every gradation between the three forms and because they always occur together and rise and fall together in numbers so far as my experience has gone. The specimens in the collection were determined by Dr. J. B. Smith; also by Mr. Otto, Heidemann through the courtesy of Dr. L. O. Howard.

ment. The females taken in the fall have, almost without exception, contained fully formed ova. Neither have I ever known the fall brood to be noticeably abundant, only occasional specimens being taken.

About the first of May there were several newspapers of the State reporting the presence of some kind of army worm in millions in different localities. On April 31 I went to Fort Morgan where extensive injuries from such an insect were reported. In company with Senator W. A. Drake, several farms were visited and the injuries of the worm noted. In one instance the Chapinan brothers had sowed alfalfa seed in the spring of 1902 and secured a good stand and then the alfalfa suddenly disappeared, from some unknown cause, for a distance of four or five rods along the border of the field adjoining wild land. The strip was re-seeded May 28 and a good stand secured which grew thriftily throughout the summer. The past spring alfalfa in this field made a good start again and at the time of my visit it was rapidly disappearing. An examination showed the cause to be cutworms.

Another field of the previous year's seeding belonged to Mr. Burnett and seemed to be perfectly bare, but on examination the little alfalfa stocks could be seen everywhere, but the leaves and tender new shoots had all been eaten down by the worms.

On Senator Drake's farm a large field of virgin soil had been plowed and sowed to barley early in the spring. The barley came up nicely all over the field and then suddenly disappeared. To one driving past this field there was no evidence that there had been a green thing growing there a few days before. I went into the field and could not find a single spear of barley but upon digging down from one to two inches could find the stubs of the young plants and the worms. The senator told me later that the barley did not appear again so that the fields had to be replanted.

Other fields were visited and it soon became evident that there were two types of injuries. In some cases the fields of grain and alfalfa were attacked about the borders only, while in others the injuries seemed equally distributed throughout the field. A little inquiry revealed the fact that in all cases where the virgin soil had been plowed in the spring and seeded the injuries were distributed throughout the field, but where the virgin soil had been plowed the previous fall or summer, the cutworm injuries were only noticed about the borders of the fields and only those borders that were adjacent to wild land. Fort Morgan is in a grazing region and the ground is pretty well covered with a mixture of gramma and buffalo grasses which are evidently among the native food plants of this cutworm, in fact the worms were found feeding upon these grasses.

About the first of May reports began to come in of extensive injuries to sugar beets from cutworms. As near as could be determined not less than four or five hundred acres of beet land in Northern Colorado had to be re-seeded this year because of the ravages of cutworms. Next to virgin soil, the fields that were in grain the previous season seem to have suffered most and barley seems to have been the grain that attracted the moths for the deposition of their eggs far more than any of the others.

On May 29, in company with Mr. H. H. Griffin, one of the field agents for the Fort Collins Sugar Company, I visited Mr. John Hice's farm near Fort Collins. He partially plowed a field of barley stubble late last fall and then finished plowing in the spring and put the field in to beets. The beets on the fall-plowing were in very good condition, but upon the spring plowing they were so badly taken by the worms that it was decided to re-plow the entire field and seed again. At that date, May 20, the worms were fast disappearing and many pupæ could be found and fields seeded after this date were not seriously attacked by the worms. The spring was unusually late this year so that it is probable that in an ordinary season the cutworms would do little injury to beets after the 10th or 15th of May, or after the moths begin to appear upon the windows or about the lights of our houses. May 20th was the first date we noticed them upon our windows the past summer.

On May 30, Mr. S. A. Johnson went to Aurora, a suburb of Denver, to investigate cutworm injuries and was aided in the work by Mr. H. Rauchfuss, who had written the Station concerning the injuries by the worms. Mr. Johnson found the worms mostly full fed or in the pupa state. The worms were pupating about two inches beneath the surface in vertical burrows with the head of the chrysalis towards the mouth of the burrow. The earthen cells at the bottom of the burrow were quite firm though they could be crushed without difficulty between the thumb and fingers. A quantity of the worms were brought into the laboratory and placed in breeding cages for the purpose of rearing the moths and it was found that nearly half of the worms were parasitized. The majority of the parasitized individuals seemed to be entirely eaten out beneath the skin and to be packed full of minute pupæ of a species of *Copidosoma*. In one instance 1705 of the adults issued from a single worm. See Plate I. Fig. D. Two *Ichneumon* parasites (*Ichneumon longulus* and *Amblyteles subrufus*) were also bred from the worms.

Two pupæ and worms brought into the laboratory the last of April began appearing as moths June 26.

Plowing during the summer or fall and keeping the ground clean of all vegetation until winter will give almost perfect pro-

tection against these cutworms unless there are adjacent infested lands from which the worms may migrate into the borders of growing crops.

The clandestine cutworm, (*Noctua clandestina*.)

A dark brown, almost black species, without conspicuous markings upon the wings, is also common each year in the north-eastern portion of Colorado, at least. It is a little later than the preceding species, the moths appearing about the lamps as those of *Chorizanthe auxilaris* are becoming scarce. I have never known it to be nearly so numerous as that species.

LEAF ROLLERS.

The Fruit-Tree Leaf-Roller (*Cacæcia argyrospila* Walk.)

[Pl. I. Figs. E and F.]

This insect in company with *Cacæcia semijerena*, the boxelder leaf-roller, has an interesting history in Colorado. Thirteen years ago both were destructively abundant in Northern Colorado in the vicinity of Fort Collins and Greeley. Their numbers have gradually grown less in that portion of the State until the past year or two, when they have not occurred in sufficient numbers to attract attention much north of Denver, while they are very destructive to the foliage of fruit and box-elder trees in that city and in the vicinity of Colorado Springs.

Many of the Tortricid moths vary greatly in color markings so that it is often impossible to distinguish between species without rearing the moths from single patches of eggs. There has been so much of this variation in the moths that I have been grouping under the name *C. argyrospila* that I decided to rear a few "families" from separate batches of eggs. Six egg-batches were placed in separate cloth sacks and each sack tied over a limb of a plum tree on April 23, when two of the patches, (numbers 1 and 5 of the following diagram) were beginning to hatch. These sacks were frequently examined and when the larvæ were nearly grown the contents of each sack were brought into the laboratory and placed in a separate breeding cage and the transformations noted until the moths all appeared. The records of the six cages are given as follows:

SUMMARY OF SIX BREEDING-CAGE RECORDS UPON TRANSFORMATIONS OF CACÆCIA ARGYROSPILA.

Cage numbers	1	2	3	4	5	6
Began Hatching	April 23	did not hatch.		April 23		
First Pupa	June 2			June 2	June 2	June 2
Last Pupa	June 13			June 17	June 11	June 20
First Moth	June 15		June 13	June 13	June 13	June 13
Last Moth	June 25		June 30	July 1	June 19	June 29

As egg-patches 3 and 4 were not hatching when placed in the sacks but gave pupæ and moths as early as any, it is to be presumed that they were not more than a day behind those in cages 1 and 5. This would make the shortest time from hatching of the egg to emergence of adult moth 50 days and the longest time 68 days. It is rather remarkable that in the four cases noted the first pupation occurred on the same date, June 13. This would indicate about 11 days as the ordinary time spent in the pupa stage.

Moths bred from the same batch of eggs vary in color from a dark rusty red with only one conspicuous pale yellow patch in the middle of the costal margin of the anterior wing to a light straw yellow with only faint indications of the rusty coloration outlined in a very light rusty brown. There is one typical pattern of the dark markings however, which can be traced through all the specimens. Figs. E. and F. Plate I. show twelve of these moths in two rows. All in the front row were bred from a single patch of eggs. Those in the second row are from two other patches. That all the moths from the five cages are of the same species is proven by the fact that each group has one or more moths that are exactly like some in all the other groups.

Experiments for the destruction of eggs. Several laboratory tests were made to determine the effect of certain insecticides upon the egg-patches early in the spring. They resulted as follows:

Kerosene emulsion that was one-third kerosene was applied to 6 egg patches. None of the eggs hatched.

Kerosene emulsion that was one-fourth kerosene was applied to 7 egg patches. One patch hatched well, one partially, 5 not at all.

Kerosene emulsion that was one-sixth kerosene was applied to 6 egg-patches. From one patch two larvæ emerged and from 5 none hatched.

Crude petroleum was applied to 5 egg-patches, and none hatched.

Whale-oil soap, 1 pound to 1 gallon of water was applied to 8 egg patches. Three hatched well, 2 partially and 3 did not hatch at all.

Whale-oil soap, 1 pound to 2 gallons of water, was applied to 7 egg-patches; three hatched well, one hatched about half, two hatched a very few, one did not hatch at all.

Whale-oil soap, one pound to four gallons of water was applied to six egg-patches; two hatched well and four did not hatch at all.

Lime salt and sulfur was applied to five patches; four hatched well and one did not hatch at all.

Whitewash composed of lime one pound, water two quarts, was applied to eight patches; one patch hatched well, five patches hatched about half of the larvæ and two hatched a very few.

Lime wash in the proportion of two pounds to three gallons of water was applied to seven egg-patches all of which hatched well.

Arsenite of lime in which there was about one pound of arsenic to 100 gallons of water was applied to six patches of eggs; one patch hatched well, three hatched about half the eggs, two hatched but very few.

Arsenate of lead in the proportion of a pound to five gallons was applied to 12 patches of eggs; five patches hatched well, two hatched about half of the eggs, two hatched a very few larvæ and three hatched none.

From these tests we are encouraged to think that crude petroleum and the stronger emulsions may be used quite successfully for the destruction of the eggs before the leaves appear in the spring, but whale-oil soap, whitewash, lime-sulfur-and-salt, and the arsenical poisons do not give much promise. Our whale-oil soap was very hard and probably not of good quality.

The Choke-Cherry Leaf-Roller (*Cenopsis testulana* Zell.)

Pl. I. Fig. G.

This leaf-roller is occasionally quite abundant among the small choke-cherry bushes in the foothills near Fort Collins where it builds extensive and rather loose webs. It is also an extremely variable species. In some the fore wings are pale yellowish brown almost without dark markings, in others the fore wings are a deep and rather dark rust-brown without any signs of light markings while a majority have sulfurous yellow back-ground more or less heavily marked with rust-brown. See the third or lower row of moths in Plate I. Fig. G.

BEEF WEB-WORM (*Lorostege sticticalis* Linn.)*

[Pl. I. Fig. I.]

On July 11th the writer was called to investigate the injuries being done by a horde of small striped caterpillars to onions and cabbages on a farm near Fort Collins. On visiting the farm in question it was found that in the center of a large field there was a small area, perhaps an acre, that was above irrigation and which, being neglected, had grown up to lamb's quarter. Upon these weeds the worms had fed until the plants were brown and dry. The worms then left the dead weeds and marched out like an invading army into the cultivated crops of onions and cabbages which they were devouring very rapidly at the time of my visit.

*Determined by Mr. Coquillett through kindness of Dr. L. O. Howard.

Two days later, word came to the Station that some worm had appeared in great numbers in many of the fields of young beets. A ride through the infected area in company with Mr. Charles Evans, manager of the Fort Collins Beet Growers' Association, revealed the fact that nearly if not quite all of the injuries from worms were to fields that had been plowed in the spring. In most of these fields considerable alfalfa was growing at the time of our visit.

To avoid such injuries as the above, do not allow lamb's quarter (*Chenopodium sp.*) to grow in proximity to other crops, and, in case alfalfa ground is to be put in to cultivated crops it would be better to plow the previous fall, but in any case keep the ground sufficiently cultivated to keep down any growth of alfalfa which might attract the moths for the purpose of egg-laying early in the season.

THE GOOSEBERRY FRUIT-WORM (*Dakruma Convolvutella*) (?)

The gooseberry fruit-worm has become a serious pest, especially to currants, along the foot hills of the eastern slope in this State. It is not uncommon to hear that this insect has destroyed the greater portion of the crop. It also feeds freely upon a common wild currant, *Ribes aurium*, which grows in the foothills, a fact which adds much to the difficulty of keeping the pest in check.

PLANT LICE (*Aphididæ*.)

Several species of plant lice were extremely abundant again during the past summer. Various insecticide substances have been used experimentally against these lice both in the egg and in the later stages and a press bulletin, No. 20, entitled "Plant Lice and their Remedies," written by Mr. S. Arthur Johnson has been issued by the Station.

The apple plant louse (*Aphis pomi*) has been extremely abundant and quite destructive to small trees in some localities. For several years past there have been many trees, particularly small ones, that have had many of their small limbs literally blackened with eggs of this insect. Such trees are common in the orchards of Northern Colorado during the present fall. I have observed such trees for several years and have never known more than a very small fraction of the eggs to hatch in the spring. In fact in some cases I have been unable to find that any of the eggs upon a tree have hatched. I am confident that not more than one egg in a thousand hatched in the vicinity of Fort Collins last spring and yet by the middle of June the lice were common in orchards and gradually increased in numbers so that from the middle of July on through the summer the lice on the apple trees of this section were exceedingly numerous. I have never seen any evidence that

this louse has an alternate food-plant in Colorado, at least it is continuously upon apple, and pear trees from the opening of the leaves in spring until the eggs have been deposited in October and November.

The green plum louse, (*Aphis pruni*), the black cherry louse, (*Myzus cerasi*), the boxelder louse (*Chaitophrous negundinis*), the snow-ball louse (*Aphis viburni*) and the woolly louse (*Schizonocura lanigera*) of the apple, were all of them specially abundant. The beet-root louse (*Tychea brevicornis*) has been reported by Mr. P. K. Blinn, field agent for the Station in the Arkansas Valley, as quite generally distributed in the beet fields in the vicinity of Rockyford and as attacking the roots of many weeds. He reports a louse that seems to be this species as very abundant and quite injurious to the common garden purslane. One beet field of eight acres near Fort Collins, investigated by Mr. Johnson, has been badly infested by this louse and, apparently, the crop has suffered considerably from it.

A full report upon the results obtained from the use of insecticides for the destruction of the lice and their eggs will be given in a bulletin later, after farther tests have been made. I may say here that we seem to have been entirely successful in destroying eggs of the lice with strong applications of kerosene emulsion, crude petroleum or whale-oil soap, made early in the spring.

FALSE CHINCH-BUGS (*Nysius minutus* and *N. californicus*).

These two species of false chinch-bugs are abundant in Colorado and their combined attacks upon mother beets in the Arkansas valley make it almost impossible to grow beet seed there. Mr. P. K. Blinn, writing under date of June 29, 1903, said he had just collected in one hour's time 20 pounds of these bugs from a patch of mother beets by brushing the insects into a dish held in the hand. Mr. Blinn also reported radishes, and mustard, planted near the beets as trap crops, of no value as the bugs were as abundant on the fields of beets as on the trap crops. He also stated that mother beets grown in a field surrounded by oats were not injured by the bugs. These bugs seem partial to plants of the mustard and goose-foot families and I do not remember to have seen them attacking any of the grasses. It is possible that any of the grains would afford barriers that would be rather effectual in excluding them. Wild mustard is a favorite food-plant for these false chinch-bugs. About nine-tenths of the specimens received from Mr. Blinn from beets were (*N. minutus*.)

Some have thought these insects to be the chinch-bug of the prairie states farther east, but such is not the case.

WESTERN WHEAT-STEM MAGGOT, (*Pegomyia cerealis* n. sp.*)

On the 5th of last May complaint came to this office that a wheat field that was looking all right ten days before had, for some reason, died down badly. Mr. Johnson went to examine the field and returned with a quantity of wheat stems with maggots in their centers. There were ten acres in the field and the injuries were so severe that it was decided that all would have to be plowed under, which was done, and the field planted to sugar beets. The field had been sown to wheat for three years in succession and had been fertilized heavily with barnyard manure the past fall and sowed to winter wheat which grew but little in the fall but which made a fine stand in the spring.

The maggots burrow down the centers of the stems and feed where the latter are most tender, an inch or two beneath the surface of the ground. At the time of examination, May 5, many light colored dipterous pupæ were found an inch or two beneath the surface close to the plants upon which they had been feeding. These pupæ brought into the laboratory began giving flies June 6. The early appearance of pupæ in the field makes it seem likely that the eggs may have been laid the previous fall. If this was not the case, the flies must have emerged very early in the spring.

DESCRIPTION.

The maggots are dirty yellowish white in color and measure between 6 and 7 mm. in length by 1.5 to 1.75 mm. in diameter. At the small or anterior end the two jaws show distinctly and at the posterior end the two spiracles are black and above them is a shining black plate or chitinous piece which terminates in two short stout spines. The puparium is like the maggot in length and thickness, it is straw-yellow at first but darkens rapidly as the time for the emergence or the fly draws near. The black plate and spines of the maggot also show plainly and the extreme anterior end is blackened.

The Adult Flies. Female: length about 5.5 mm. exclusive of ovipositor. Color of head and body rather uniform light gray, set with large and small black bristles that arise, each from a small black spot. Eyes dark reddish brown, naked, separated in front by a space nearly equal to the diameter of an eye; antennæ black, the aristæ also black and slightly plumose to the tips. Color of head like that of thorax except for a slight golden tint upon the face. There are five moderately stout bristles in a row parallel with the inner margin of the compound eye on either side and another row of about 20 of these bristles along the posterior border of each eye, the two at the upper angle of the eye being larger than the others. On the thorax there may be distinguished one median and, on either side, two lateral darker stripes which are quite distinct, and upon each of which a row of stout black bristles arises. Scutellum with four setæ, two very stout ones near the tip and one not so large near each posterior angle. Abdomen rather thickly set with stout black setæ of moderate size, the largest ones arising from near the posterior margin of the segments. Femora cinereous like the body except at the knees where they change to light amber which is the color of all the tibiae; the tarsi of all the legs are deep black. The wings are hyaline, tegulæ and sub-tegulæ small and nearly equal and amber in color, as are all the large veins.

*Specimens submitted to C. W. Johnson were referred to Mr. Coquillett, who determined them, "Near *Pegomyia ceptorum*, but apparently distinct."

The males differ from the females in being of a dark cinereous brown color. The femora are also of the same color and the tibiæ are much darker than in the female. The eyes are very much larger being sub-attingent in front of the ocelli.

Described from nine males and ten females bred from stems of winter wheat.

The injuries of the fly seem to have been confined to the one field. Mr. S.A. Johnson and Mr. Fred Bishopp examined a large number of fields of winter wheat in the vicinity of Fort Collins but in no case did they find farther injuries by this insect.

The summer and fall habits of this fly are unknown.

A wing of this fly is shown in Fig. C., Pl. II.

Aspidiotus forbesi. A card from Prof. T. D. A. Cockerell, of Colorado College, states that he has found this scale abundant upon a bush of *Cercocarpus parvifolius* growing upon a hillside at Colorado City. This is a matter of sufficient importance to warrant mention of the fact in this report. It seems to be the first record for the species in Colorado.

(Explanation of plates.)

Plate I. A, B, C, three forms of the army cutworm moth (*Chorizagrotis auxiliaris*;) D, two living cutworms, a chrysalis, a dead parasitized cutworm and two earthen cells of the same species; E, moths of *Cacæcia argyrospila* (fruit-tree leaf-roller), all bred from one patch of eggs to show variation in markings; F, moths of the same species selected from specimens bred from two patches of eggs; G, choke-cherry leaf-roller (*Cenopsis testulana* Zell.), all from one tent showing variation in color; H, Grain-bug, (*Pentatoma sayi* Stal), and wheat kernels shrunk from attack of the bug, also two plump kernels for comparison; I, two larvæ of web-worm (*Loxostege sticticalis* Linn.)

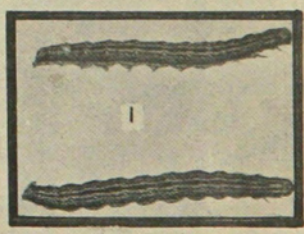
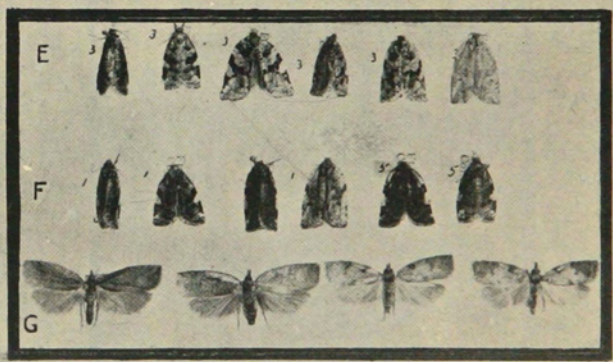
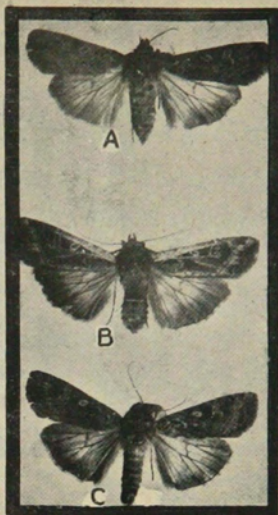
Plate II. A, head of oats blasted from attacks of grain-bug (*Pentatoma sayi*), only three developed kernels; B, apple injured and deformed from application of too strong spray of Paris green; C, wing of western wheat stem-maggot (*Pegomyia cerealis*).



JAMES M. CONNELL, SCHOOL SUPPLIES, DENVER, CO.

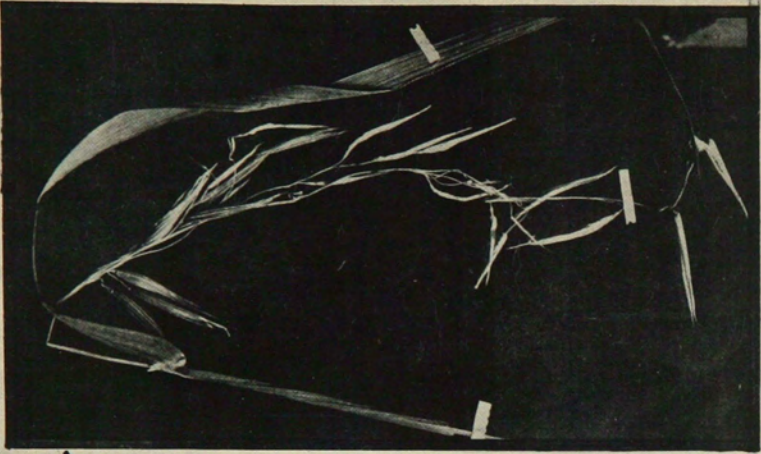
PUBLISHED BY

The Xs east of Fruita on the Grand River are for Grand Junction and Palisades.

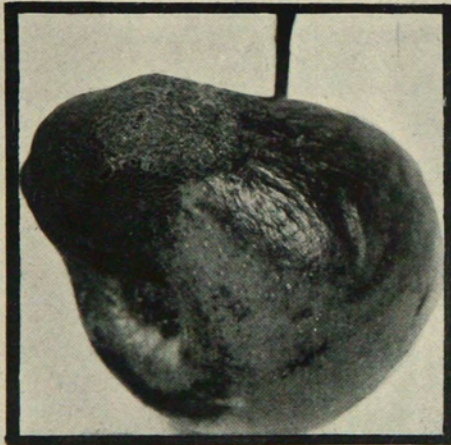


COLORADO EXPERIMENT STATION

PLATE I.



A



B



C

COLORADO EXPERIMENT STATION

PLATE II.

Annotated List of Colorado Orthoptera

From Material in the Collections of the Colorado Agricultural College and Agricultural Experiment Station.

PART I.

Including Families Forficulidae, Blattidae, Mantidae, Phasmidae and Acridiidae

BY CLARENCE P. GILLETTE.

INTRODUCTION.

Since coming to Colorado about thirteen years ago, the writer has done what he could to make the rich and varied insect fauna of the State known to the world. First, the Cynipidæ were published upon in the *Canadian Entomologist* and in *Entomological News* during the years 1892, '93 and '94. Then Bull. 31, "A Preliminary List of the Hemiptera of Colorado," by Gillette and Baker, was published by the Experiment Station in 1895. In 1898 Bull. 43 was issued giving a list of the Lepidoptera in the College collection with the accessions notes upon them and also giving descriptions of a few new Jassidæ from the State; and the same year the writer prepared a monograph of the "American Leaf-hoppers of Subfamily Typhlocybince" which appeared in Vol. XX of the Proc. of the National Museum which included much Colorado material. When Prof. E. D. Ball came to this department as first assistant in 1897 he had already become a writer upon the family Jassidæ and was encouraged to continue his systematic work with this group, with a special view of working up the Colorado fauna, and his articles since that time have added much to our knowledge of Colorado Hemiptera. Mr. E. S. G. Titus wrote his thesis for the degree of M.Sc. upon "Colorado Bees," a bound copy of which is in the College library; and Mr. Titus also wrote numerous articles treating of Colorado bees that were published in the *Canadian Entomologist*. Our entire College collection of Colorado Coleoptera were sent to Prof. Wickham to be used by him in making out his list of Colorado Coleoptera which he published in the *Canadian Entomologist*. Many other papers have appeared from the pens of other entomological workers in which they report upon insects

from the collection of the Colorado Agricultural College and the present paper is another attempt to add to the existing knowledge of the insect fauna of the State. I hope to follow this paper at no distant date with another giving our records upon the remaining families of the order Orthoptera.

It is hoped that the present paper will be found fairly free from errors in determinations. There are still a few species of Acridiidae not reported because of uncertain identifications and it is probable that, in a few instances, I have included under one name forms that have been considered distinct but which I could not separate except from differences in size or coloration.

BROODS.

All of our records point to one conclusion, and that is that all the species here reported are probably single-brooded.

The number of species reported in this paper are:

Forficulidæ	0
Blattidæ	5
Mantidæ	5
Phasmidæ	2
Acridiidæ	133
Total	145

DISTRIBUTION AND BARRIERS.

There are almost no cases where sharp lines of limitation in this State shut in the distribution of a species. The Continental Divide, and the line made by the sudden breaking of the eastern plains into the foothills and canons of the eastern slope, come nearest to being such barriers; and a few species seem rather closely confined to the area lying above timberline upon the mountain ranges. As a general rule, species that occur over the eastern plains also occur for some distance into the mountainous region but they seldom range higher than 7,000 or 8,000 feet, and many of the plains species occur but a very short distance in the hills. On the other hand mountain species that are common at 9,000 and 10,000 feet altitude are seldom found outside the foothills. Some species occurring abundantly above timber-line may be found all the way to the base of the eastern line of foothills, and *Blattella germanica*, that thrives so well at the sea shore, is equally prolific and aggressive in eating houses at mines located above timberline in the mountains. There are very few species except those that follow in the wake of civilization, that occur upon both the eastern and western slopes of the Continental Divide. A few species from the south and east have found their way up the Arkansas valley into the southeastern portion of the State that we have not found elsewhere, and several species occurring in the Platte valley of the

northern plains region we have not found occurring in the valley of the Arkansas.

The frontice piece is a map giving the main river systems and water sheds of Colorado with the points named where our collections have been made. Upon page 20 I have given a list of the places where collecting has been done, with their altitudes, and with each species I have given all the localities from which it has been taken by us. The reader will thus be able to make out the distribution of such species so far as determined by our records.

ACKNOWLEDGMENTS.

DETERMINATION OF SPECIES.

The Blattidæ here reported have been determined by Prof. Lawrence Bruner or by comparison with examples named by him. The Mantidæ and Phasmidæ have been determined by Professor Bruner, A. N. Caudell or E. D. Ball. The entire collection of Tettiginæ has been through the hands of Prof. Albert P. Morse and are reported as named by him. The remainder of the Acridiidae have been named very largely by comparison with examples of the various species that were determined for the College by Prof. Bruner or Dr. S.H. Scudder, to whom doubtful and unknown species have been referred. The more readily determined species have been named by E. D. Ball or the writer. All errors are chargeable to me, as I have worked over the entire collection during the past year, adding many species and many new records and changing many names. Prof. Morse has also determined several species of Trimerotropis and Spharagemon for me.

COLLECTORS.

The collection upon which this report is based has been accumulated during the past thirteen years as the result of the efforts of many helpers. An examination of 1,500 entries upon the Accessions Book shows that about 50 per cent. of the records are from collections and observations made by E. D. Ball, about 25 per cent. by the writer, and the remaining 25 per cent. by others, most prominent among whom are S. A. Johnson, E. S. G. Titus, E. P. Taylor, F. C. Bishopp and C. F. Baker. I have also received several species from Prof. T. D. A. Cockerell from the vicinity of Colorado Springs and Pike's Peak.

The original plan was to publish this report in joint authorship with Prof. E. D. Ball who was, at the time, my first assistant; but after his appointment to the Chair of Animal Biology in the Agricultural College of Utah, this plan had to be abandoned. I wish specially to acknowledge my obligations to Prof. Ball for the large

amount of work which he did in collecting material and data and making determinations preliminary to the preparation of this report.

The photographic reproduction of the topographical map of Colorado shown in this report is used with the permission of the "Continental School Supply Company" of Denver who own the original map.

PAPERS.

I am under special obligations to Professor Lawrence Bruner, and Professor T. D. A. Cockerell for permission to publish their papers describing Colorado insects in this report.

LOCALITIES AND THEIR APPROXIMATE ALTITUDE.

Akron (G)	4,650	Grand Junc'n (G).....	4,594	Montrose (G)	5,811
Alder (G)	8,500	Gray's Peak (G).....	10,000	Nepesta (B).....	4,400
Alamosa (B).....	7,540	Greeley	4,637	New Castle (G).....	5,562
Alma	10,240	Gunnison	7,685	North Park.....	8,500
Antonito	7,889	Gypsum (G).....	6,325	Orchard (B).....	4,591
Bald Mountain.....	8,500	Hague's P'k(S).....	11,000	Ouray (G)	7,706
Boulder (G).....	5,300	Hamilton (J).....	6,400	Palisades(G).....	4,741
Buena Vista (B) ..	7,967	Hayden (J)	6,800	Palmer Lake	7,237
Cameron Pass(B).....	10,000	Hebron (J).....	8,500	Pagoda (J).....	6,500
Canon City (G) ..	5,343	Holly (B)	3,400	Paonia (G).....	5,500
Cerro Summit (G).....	7,968	Home (B).....	9,000	Pinewood (B)	8,000
Chama (N. M.) ..	7,863	Idylwilde (J).....	9,000	Pueblo (B).....	4,668
Claremont (G).....	3,650	Julesburg.....	3,456	Rico (B).....	8,737
Colorado Springs ..	6,000	La Fayette (G).....	5,179	Ridgway (Jo)	7,500
Cortez (J).....	7,000	La Junta	4,061	Rifle	5,310
Craig (J).....	6,500	Lamar	3,600	Rist Canon.....	5,500
Delta (G).....	4,980	La Salle.....	4,663	Rocky Ford.....	4,177
Denver.....	5,200	Laporte	5,200	Salida (G).....	7,050
Dolores (J).....	6,957	Las Animas (B).....	3,900	Silverton (Jo).....	9,224
Durango.....	6,520	Lay (J)	6,163	Snyder (B).....	4,160
Dutch George's(B).....	7,000	Leadville (G).....	10,200	Steamboat Spr'gs.....	7,300
Eddy (G).....	7,000	Little Beaver	9,000	Sterling	3,920
Elbert (G).....	6,710	Livermore	6,000	Stove Prairie.....	7,500
Erie (G).....	8,179	Lizard Head (B).....	10,200	Timnath.....	4,560
Estes Park (G).....	8,000	Long's Peak (G).....	11,000	Trinidad	5,980
Fort Collins.....	5,000	Loveland (G)	5,000	Walden (J).....	8,500
Fort Morgan (B) ..	4,263	McCoy (G)	7,300	Ward (B).....	10,000
Fruita (G).....	4,500	McElmo (G).....	6,800	Wheat Ridge.....	5,300
Georgetown (G).....	8,476	Manitou (G).....	6,200	Windsor (G)	4,900
Glendevy (J).....	3,000	Marshall Pass(G).....	10,856	Wolcott (G).....	6,976
Glenwood Sp. (G).....	5,758	Maybell (J)	6,000	Wray (B).....	3,500
Golden (G).....	5,700	Merino (B).....	4,021	Yuma (G).....	4,128

The altitude given in each case is that of the town or place itself. The grasshoppers referred to the different places were often taken at much greater altitudes. Silverton, for example, has an altitude of 9,224 feet but the insects referred to Silverton were taken on a mountain near by at an altitude of over 12,000 feet. This will account for my giving altitudes farther on in this

paper, for the occurrence of some of the species much higher than the altitude of any of the stations where the species was taken.

NOTE—Names of places followed by the capital (B) were collected in by Prof. E. D. Ball only; those followed by (J) were collected in by Mr. S. A. Johnson only; those followed by (S) were collected in by Dr. J. W. Skinner only; those followed by (Jo) were collected in by Mr. Charles Jones only, and those followed by (G) were collected in by the writer only.

Family FORFICULIDÆ.

We have not taken a representative of this family within the State.

Family BLATTIDÆ.

BLATTELLA Caudell.

germanica Linn. Specimens in the College collection are from a boarding house in Ft. Collins and from a boarding house at a mine near Silverton at an altitude of 12,000 feet, where they were very numerous in both instances, and a single specimen from a hotel at Leadville.

NYCTOBORA Burmeister.

holosericea Klug. One male and one female taken at Ft. Collins, June 5th, 1900.

mexicana Sauss. Occasionally introduced upon bunches of bananas from the south.

PERIPLANETA Burmeister.

americana Linn. A few examples from Ft. Collins and Denver.

orientalis Linn. One specimen taken at Golden, Colo., April 30th, 1902.

Family MANTIDÆ.

YERSINIA Saussure.

solitaria Scudd. Specimens of what seems to be this species have been taken at Ft. Collins, Palmer Lake, Durango and Alder. They have been taken in open places running about in short grass and so imitating the ground and dry leaves that they are never seen until they move. Rare.

LITANEUTRIA Saussure.

borealis Brun. Specimens of this species have been taken at Ft. Collins, Dutch George's, Holly and at Stratton and Kimball in Nebraska. Rare in Colorado.

minor Scudd. This species probably occurs quite generally over the plains region east of the foothills and a few miles into the hills, on dry grassy ground. Specimens have been taken at Ft. Collins, Dutch George's, Greeley, Pueblo and Trinidad.

obscura Scudd. A few specimens of what seems to be this species have been taken on the western slope at Grand Junction.

STAGMOMANTIS Saussure.

carolina Linn. A few specimens have been taken at Nepesta and at Grand Junction.

Family PHASMIDÆ.**DIAPHEROMERA** Gray.

veliei Walsh. Taken at Holly, Sept. 8, '98, on corn, and at Julesburg Aug. 7, 1902 on grass on low ground. Rather common in both instances. (Ball.)

PARABACILLUS Caudell.

coloradus Scudd. A few specimens have been taken at Ft. Collins both inside and outside the foothills. In one instance two specimens were taken from a species of *Eriogonum*, July 27, '99. One of these was mature and one immature. We also have specimens from Kimball, Neb., taken Aug. 5th, 1899.

Family ACRIDIIDÆ.**TETTIX** Charpentier.

acadicus Scudd. A single specimen taken at Steamboat Springs July 16, 1894. (Baker.)

crassus Morse. A common species in northeastern Colorado on low ground adjoining the foothills and near the streams in the canons. The adults hibernate during the winter among dead leaves. Most of the adults have been taken in the fall and early spring. This species varies much in color and in the length of the pronotum. Species taken at Ft. Collins, Laporte and Steamboat Springs only. Most of the specimens were taken in the foothills near Laporte.

hancocki Morse. Four specimens, all taken in Rist Canon near Laporte, June 15, 1898. (Ball.)

incurvatus Hanc. One specimen from Rist Canon, near Laporte, June 15, 1898, one ten miles farther back in the foothills July 21, 1898 (Ball.); and one specimen at Salt Lake, Utah, 6-16-'00. (Gillette.)

tentatus Morse. Two species taken at Little Beaver, 7-19-'98 at about 9,000 feet altitude, (Ball.); and two specimens taken in Estes Park, one July 11, and one July 15, '94, (Gillette). The last two named were rather immature. Altitude about 8,000 feet.

PARATETTIX Bolivar.

cucullatus Burm. A few specimens have been taken from the plains and foothills in the vicinity of Ft. Collins and a single specimen was taken at Lamar. The dates are in the months May and June.

tollicus Sauss. Four specimens, three taken in Rist Canon near Laporte, June 26, 1898, (Ball.); and one taken along the river near Ft. Collins 6-12-'97. (Gillette.)

MERMIRIA Stal.

bivittata Serv. Common over the entire eastern portion of the State to some distance within the foothills. This species seems to prefer the higher ground and is often abundant upon hill-tops. We have recorded specimens from Ft. Collins, Laporte, Windsor, Greeley, Orchard, Julesburg, Wray, Rockyford and Holly.

We have taken adults at Ft. Collins as early as July 10th and as late as Sept. 10th. They doubtless continue much later.

neomexicana Thom. This specimen seems to cover about the same ground as the preceding though it is much less abundant

We have specimens taken at Ft. Collins, both within and outside of the foothills, and also a few specimens taken at Rockyford, Holly and Nepesta. Our captures have all been made during August and September.

ACROLOPHITUS Thomas.

hirtipes Say. We have found this species most common in the gulches of the outer foothills and upon the dry hillsides. It probably occurs in small numbers over most of the plains of the eastern portion of the State. At Ft. Collins adults begin to appear about the last week in June. All our specimens have been taken before the last of August. Most of them are uniformly green in color but several individuals have a lighter shade, varying from light green to almost white upon the elytra and pronotum. Upon the elytra the lighter color is so distributed as to leave the green, for the most part, in round or oval blotches.

Specimens from Ft. Collins, Laporte, Livermore, Dutch George's, Wray, Greeley, Boulder, Golden, Las Animas and Coolidge, Ks. July 7, '02 all adult and eggs mature at Laporte. (Ball.)

ERITETIX Bruner.

navicula Scudd. Specimens answering to the description of this species seem not to be specifically distinct from *tricarinatus*. Perhaps Caudell is correct in thinking all the Colorado forms are *navicula*. See "note on Orthoptera, etc." by A. N. Caudell, Proc. U. S. National Museum, Vol. xxvi.

tricarınatus Thom. A common species on dry grass land in the eastern portion of the State and extending some distance into the foothills. Most common northward and near the foothills. Adults taken in northern Colorado from May 11th to August 13th.

Specimens have been taken at Ft. Collins, Laporte, Dutch George's, Virginia Dale, Livermore, Boulder, Palmer Lake, and Pueblo.

variabilis Brun. This species seems to be very generally distributed over the State up to an altitude of about 6,000 feet. We have taken it on grassy areas. It seems to feed mostly upon salt grasses. Adults were just beginning to appear at Ft. Collins June 22, 1899 (Ball) and we have taken them up to Sept. 23rd.

Specimens have been taken at Ft. Collins, Laporte, Windsor, Timnath, Greeley, Merino, Snyder, Julesburg, Boulder, Denver, Pueblo, Nepesta, Rockyford, Lamar, Holly and Delta.

AMPHITORNUS McNeill.

bicolor Thom. A very common species on dry grassy slopes over all the eastern portion of the State, particularly, northward near, and for some distance within the first foothills. Specimens have been taken at an altitude of fully 8,000 feet. This insect doubtless causes heavy losses on the native pasture lands of the State.

June 29, 1901, a single pair of adults and many young were found in the foothills west of Ft. Collins; June 6th, 1902, in the some locality only young nymphs could be found; at Greeley, June 23, 1902, several adults were seen. (Ball.) Our latest captures of this species at Ft. Collins were made Sept. 5, 1901.

Specimens have been taken at the following places: Ft. Collins, Laporte, Dutch George's, Livermore, Westlake, Windsor, Greeley, Merino, Wray, Julesburg, Snyder, Boulder, Denver, Rockyford, Las Animas, Holly, Lamar, Alder, Dunkley and Steamboat Springs.

CORDILLACRIS Rehn.

affinis Morse. A single male answering to the structural characters given for this species, but having the dark stripe of the hind femora solid, was taken by Mr. S. A. Johnson at Hayden, July 29th. The hind tibiæ are very pale yellowish tinged with dusky and not at all red.

cinerea Brun. What I have placed under this name seems to be a light colored form of *occipitalis*, and it occurs over about the same area. Perhaps my specimens are not true *cinerea*, but if so, we have not taken this species in the State.

cronulata Brun. Generally distributed on dry grassy areas east of the Continental Divide to 8,000 feet altitude and also occurring over some of the western slope. It seems to be a grass feeder. The earliest that adults have been seen at Ft. Collins is June 26, 1901. (Ball.) They continue until the middle of September.

Specimens taken at Ft. Collins, Laporte, Windsor, Greeley, LaSalle, Wray, Boulder, Denver, LaFayette, Colorado Springs, Pueblo, Rockyford, LaJunta, Lamar, Las Aninas, Trinidad, Ridgway, Antonito, Durango and Grand Junction.

occipitalis Thom. The notes for the preceding species may be repeated for this. In addition to the above localities we can add Dolores, Salida, Golden, Virginia Dale, Timnath, Ft. Morgan, Julesburg, Merino, Trinidad, Alamosa, Antonito and Durango.

Specimens from Trinidad, Alamosa, Antonito and Durango are darker in color and the elytra are longitudinally striped with dark fuscous with or without light yellow spots, but I do not take this form to be specifically distinct from the specimens from other parts of the State as there is considerable inter-gradation.

PHLIBOSTROMA Scudder.

quadrimaculatum Thom. A very common species feeding upon prairie grasses, particularly on the plains of the northeastern portion of Colorado. The species occurs in the foothills at an altitude of about 8,000 feet. It varies much in size and color, and in wing-length. This is one of our most destructive species to prairie grasses.

Specimens taken at Ft. Collins, Laporte, Dutch George's, Virginia Dale, Livermore, Windsor, Greeley, La Salle, Snyder, Sterling, Lafayette, Denver, Golden, Boulder, Pinewood, Pueblo, Colorado Springs, Rockyford, Holly and Buena Vista.

Adults taken at Ft. Collins from the 24th of June, 1901, until the 12th of October, 1898. Fully developed eggs found in females July 27th, 1901. (Ball.)

ORPHULELLA Giglio-Tos.

pelidna Burm. Thomas in writing of this species has said "Burmeister's description is so meager that it is doubtful whether it will ever be recognized with satisfactory certainty." What

I am calling this species is common in the northern plains portion of the State upon grassy areas and we have taken it in the foothills to an altitude of 5,500 feet. The males measure from 15 to 18 mm. and the females between 18 and 21 mm. in length. On going south this form gives way to a larger and longer winged form that I am calling *pratorem*. Scudd.

The specimens have been taken at Ft. Collins, Laporte, Windsor and Greeley. Adults have been taken as early as July 22, and as late as September 17th.

pratorem Scudd. What I am calling this species is abundant in the northern portion of the State east of the foothills and is also common in the southern portion. The males range between 18 and 20 mm. and the females between 21 and 24 mm. in length.

The specimens in the College collections have been taken at the following points: Ft. Collins, Greeley, Sterling, Snyder, Pueblo, Rockyford, Lamar and Holly in Colorado, and Stratton in Nebraska. See *Orphulella pelidna*.

salina Scudd. This low-ground species has been taken by us upon the west slope only in the vicinity of Delta and Grand Junction from July 7 to Sept. 23. On Sept. 17th, 1903, it was noted as the most abundant grasshopper on salt-grass, *Distichlis maritima*, growing through a heavy deposit of alkali on low ground near Delta. (Gillette.)

CHLÆALIS Harris.

conspersa Harr. We have taken this species on five different dates at altitudes from 5,500 to 6,000 feet in the foothills west of Ft. Collins. The captures have all been from a single canon known as Horse-tooth Gulch and between July 10th and Aug. 12th. A single female was also taken in the foothills near Boulder July 23rd, 1901.

The females vary between 22 mm. and 24 mm. in length and their elytra vary between 8 mm. and 10 mm. in length. The males are from 18.5 mm. to 21 mm. in length and their elytra are from 9.5 mm. to 12.5 mm. long. In three of the males the entire sides of the pronotum to the lateral carinæ are black. In two others the lower portion is brown. The females lack the black dash upon the upper posterior angles of the sides of the pronotum. There are other reasons, particularly in the elytral venation of the males, for thinking that this Colorado form may be a new species.

STENOBOTHRUS Fischer.

curtipennis Harr. A common species on native grasses along the mountains and foothills of the State and occurring in smaller numbers across the plains of the northern portion. We have found it most abundant at altitudes of 8,000 to 9,000 feet. We have taken adults as early as June 26th in the foothills near Ft. Collins and as late as Sept. 30th in the same place. We have taken no females with elytra long enough to reach to the tip of the abdomen. With the males, however, the wings just attain the tip of the abdomen.

Specimens taken at Ft. Collins, Laporte, Dutch George's, Home, Sterling, Orchard, Merino, Greeley, Ward, Salida, Gunnison, Antonito, Lizzard Head, Alder, Cameron Pass and Walden.

PLATYBOTHRUS Scudder.

brunneus Thom. Both sexes taken in and near Estes Park, Aug. 11 to 13, 1903, sweeping native grasses between altitudes of 7,000 and 8,500 feet.

GOMPHOCERUS Thunberg.

clavatus Thom. This is preeminently a high-altitude species, though it occurs down to an altitude of something less than 5,000 feet, and has been taken by us along the Cache la Poudre river seven miles from the foothills. It occurs in large numbers on grassy areas above timberline. We have recorded it abundant on Mt. Ouray (near Marshall Pass) at 12,500 feet altitude, Aug. 27th, 1899.

In the foothills near Ft. Collins we have taken adults as early as June 17th, and on Marshall Pass as late as Oct. 7th. In the lower altitudes the species is not abundant.

We have taken specimens at Ft. Collins, Laporte, Dutch George's, Livermore, Westlake, Stove Prairie, Little Beaver, Home, Pueblo, Ward, Pike's Peak at 12,000 feet (Cockerell), Marshall Pass (on Mt. Ouray), and Cerro Summit.

The Colorado specimens are larger than Thomas' type, females measuring between 18 and 22 millimeters in length, with elytra 4.5 mm. to 8 mm. long, and males measuring between 15.5 mm. and 18 mm. in length.

It seems strange that the type of this species should have been recorded as taken in Kansas. Probably this is an error.

BOOPEDON Thomas.

nubilum Say. A rather common species along the Arkansas valley from Pueblo down, on moist ground where grasses grow. A few specimens have been taken from wheat and corn fields.

Outside of the Arkansas valley a specimen was taken at Wray (Ball). We have taken this species at Pueblo, Nepesta, Rockyford, Las Animas, Lamar and Wray.

All the males are black with hind tibiae more or less red and with elytra nearly attaining the tip of the abdomen. In length they vary between 20 mm. and 27 mm. (52 specimens). Out of 30 females, 26 are dusky and greenish, marked with yellow, and four are black. They vary in length between 31 mm. and 44 mm., and, with one exception, the wings are short, about 12 mm. long. The single long-winged female has elytra surpassing the tip of the abdomen.

flavofasciatum Thos. Probably the light-colored form of the preceding species.

STIRAPLEURA Scudder.

decussata Scudd. Occurs across the plains and in the mountains to an altitude of 8,000 feet. Quite abundant in the vicinity of Ft. Collins. Occurs commonly in open grassy areas; food-plants not known.

Taken at Ft. Collins, Laporte, North Park, Denver, Colorado Springs, Pueblo, Rockyford, Lamar, Canon City, Trinidad, Antonito, Gunnison, Claremont, Elbert and Dunkley.

AGENOTETTIX McNeill.

deorum Scudd. What I take to be typical examples of this species in the collection are from Colorado Springs (Cockerell), Pueblo and Boulder, though others nearly as typical come from Rockyford, Ft. Collins and other points. This species seems to me to grade imperceptibly into *scudleri*.

occidentalis Brun. (See description following this article).

A west slope species, the specimens in the College collection coming from Antonito, Durango, Grand Junction, Glenwood Springs and Delta. Dates—Aug. 5th to Sept. 23rd.

scudleri Brun. A common species upon the plains near the foothills, particularly in the northern portion of the State. It extends to the eastern border of Colorado and to an altitude of 6,000 feet at least in the foothills. Adults begin to appear at Ft. Collins about June 20th and we have taken them as late as Sept. 28th. Adults were mating freely July 30th, 1902. (Ball.)

Specimens taken at Ft. Collins, Laporte, Dutch George's, Livermore, Greeley, Ft. Morgan, Snyder, Merino, Wray, Sterling, Julesburg, Boulder, Palmer Lake, Pueblo, Rockyford, Las Animas and Lamar. This species seems to me to be a unicolorous variety of *deorum*.

AULOCARA Scudder

elliotti Thom. This is also a very abundant species over the grass-covered plains of the eastern portion of the State, and occurs upon open grassy areas in the mountains to an altitude of 8000 feet. Adults appear in the vicinity of Ft. Collins about the middle of June and the sexes have been taken *in coitu* as early as July 2.

The 75 females in the collection vary in length between 21 mm. and 27 mm. and their elytra between 16 mm. and 18 mm. The males vary between 17 mm. and 20 mm. and their elytra between 11 mm. and 17 mm.

There is a wide variation in the colors. The common one is a dingy brown, slightly tinged with rufous, with more or less numerous brown spots, particularly upon the elytra. Occasional specimens are deep ferruginous in color with or without the fuscous spots upon the elytra and with the posterior portion of the dorsum of the pronotum deeply infuscated. Specimens from the higher altitudes (Buena Vista, Antonito and Gunnison) are smaller and are of a dark slate color with markings very inconspicuous.

Our specimens came from the following places: Ft. Collins, Laporte, Pike's Peak at 9000 feet (Cockerell), Dutch George's, Livermore, Sterling, Boulder, Lafayette, Va. Dale, Nepesta, Rockyford, Lamar, Trinidad, Canon City, Buena Vista, Antonito, Durango and Dunkley.

femoratum Scudd. A very abundant species near the foothills in northern Colorado. It occurs among the native grasses which probably serve as its food plants. It occurs entirely across the plains to the eastward but we have not found it occurring far back in the foothills nor upon the western slope. On July 16, 1902, adults were just beginning to appear in the foothills west of Fort Collins (Ball). In 1901 a few males were found in the same locality June 29, and on July 26th of this year Mr. Ball found females containing fully developed eggs. Occasional specimens have been observed at Fort Collins as late as Sept. 30, (1902).

This species has been collected at Ft. Collins, Laporte, Dutch George's, Windsor, Greeley, Ft. Morgan, Boulder, Rockyford, Las Animas, Lamar and Holly.

An examination of the 74 females and 52 males in the collection shows that the former vary between 19 and 25 mm. and their elytra between 12 mm. and 19 mm. in length, and that the latter vary between 14 mm. and 17 mm. and their elytra between

7 mm. and 12 mm. in length. The smaller size, shorter wing, conspicuous black bands upon the hind femora, and absence of the lower ridge for the inclosure of the frontal fovea easily separate this species from *elliotti*. In general appearance, the females of the two species are very similar.

rufum Scudd. We have found this species fairly common in the valleys of the Arkansas and the Rio Grande rivers and also at an altitude of about 8000 feet at Gunnison. We have also taken it upon the plains at Greeley and at LaSalle but not at Ft. Collins. The captures have been between June 24 (Greeley) and Aug. 11 (Denver).

Taken at Greeley, LaSalle, Denver, Pueblo, Nepesta, Rockyford, Lamar, Antonito and Gunnison.

This species also varies greatly in color. There are colors from light to dark slate through various shades of ferruginous. In some the elytra are conspicuously spotted with brown while in others the maculation is almost entirely absent. The posterior margin of the dorsum of the pronotum is usually darkened so as to be in sharp contrast to the lighter color of the elytra.

ARPHIA Stal.

frigida Scudd. We have taken this species at altitudes ranging between 5500 feet in Rist Canon near Ft. Collins and 12,000 feet on Marshall Pass.

This yellow-winged species has also been taken at Westlake, Little Beaver, North Park, Glendevy and Home. It seems to be distinctly a mountain species. We have not taken it outside of the foothills.

***pseudonietana** Thom. This large species with bright red under wings heavily bordered with black is quite abundant in northern Colorado and especially along the eastern foothills in the most barren places. It so imitates the ground upon which it rests that it can hardly be seen until it moves. It occurs to the New Mexico line in the southern part of the State. Our specimens come from the following points: Ft. Collins, LaPorte, Dutch George's, Livermore, Sterling, Home, Windsor, Greeley, Orchard, Merino, Pinewood, Denver, Boulder, Palmer Lake, Colorado Springs, Pueblo, Rockyford, Las Animas, and Lamar.

The earliest capture was at Lamar, May 7, 1892, and the latest at Palmer Lake, Oct. 9th, 1898.

*I am following A. N. Caudell in calling this species *pseudonietana* Thomas, instead of *tenebrosa* Scudder.

teporata Scudd. This species, which may be only a red-winged variety of *frigida*, is very common upon the plains in the vicinity of the foothills in northern Colorado. Our dates of capture range between March 31 and July 12 (Ft. Collins).

Our specimens have been taken at the following points within the State: Ft. Collins, Laporte, Greeley, Pueblo, and a single specimen from Silverton which may be a different species. We also have a pair of what seem identical with this form from Dunkley.

CHORTOPHAGA Saussure.

viridifasciata DeGeer. A common species in northern Colorado in the vicinity of Ft. Collins and occurring a short distance in the foothills. Adults have been taken as early as Apr. 23, and as late as July 2. The species winters as a nymph. The males (17) in the college collection are all brown. Out of the 25 females, 11 have the sides of the elytra and pronotum decidedly brown. Our specimens all came from the plains and foothills near Ft. Collins.

ENCOPTOLOPHUS Scudder.

coloradensis Bruner. See description in article following this.

costalis Scudd. Not uncommon near the foothills in the vicinity of Ft. Collins, also occurring some distance within the hills. Our specimens came mostly from near Ft. Collins, a few are from Greeley and one from Antonito.

CAMNULA Stal.

pellucida Scudd. A common species in open areas throughout the mountainous portions of the State. We have not taken it east of the foothills. More than 100 specimens in the College collection were taken at the following points: Home, North Park, Va. Dale, Dutch George's, Little Beaver, Pike's Peak at 10,000 ft. (Cockerell), Walden, Westlake, Sterling, Livermore, Stove Prairie, Cameron Pass, Leadville, Marshall Pass, Salida, Ward, Estes Park, Gunnison, Grand Junction, Rico, Hamilton, Steamboat Springs, Dolores, and Glenwood Springs. From outside the State, we have taken this species at Cheyenne, Wyo., and at Chama, N. M.

KIPPISCUS Saussure.

conspicuus Scudd. A fairly common species over the plains of the eastern portion of the State and in the lower altitudes through the mountains of the southern portion. Specimens in the collection are from Ft. Collins, Snyder, Sterling, Lamar, Pueblo, Trinidad, Antonito, and Gunnison.

The dates of capture range between May 9th and August 28 at Ft. Collins.

- montanus** Thom. Specimens determined for us by Prof. Bruner as this species were taken by Prof. E. D. Ball at Lamar, Colo., on three different dates, June 17, July 10, and July 18; and at Wray, Colo., July 13. It is one of the very largest and is the lightest colored species we have taken. The largest females measure 48 mm. in length. The hind femora and tibiæ beneath and on the inner sides are bright coral red and the metazona of the pronotum is long and acute angled posteriorly.
- neglectus** Thom. This seems to be strictly a mountain species. A single specimen has been taken on the first line of foothills west of Fort Collins at an altitude of about 5,500 feet, and at about 6,500 feet it becomes fairly common. Over 80 specimens in the College collection came from the following points: Ft. Collins (foothills), Livermore, Va. Dale, Westlake, Dutch George's, Estes Park, Home, North Park, Pike's Peak, Alder, Gunnison, Dolores, Steamboat Springs and Walden. Dates range between June 16 and Aug. 29.
- paradoxus** Thom. One male from Antonito, Aug. 5, '00 (Ball,) is all we have taken of this species. Determined by Prof. Bruner.
- variegatus** Scudd. Two males and two females taken by Prof. E. D. Ball at Holly, Colo., Sept. 8, 1898.
- zapotecus** Sauss. A few specimens of this species have been taken from the following points: Ft. Collins (foothills), Livermore, Westlake, Palmer Lake, Steamboat Springs, Eddy and Dunkley.

LEPBUS. Saussure.

- cyaneus** Ckll. Occuring in the most barren situations across the southern portion of the State. Our specimens came from Nepesta, Pueblo, Trinidad, Delta and Grand Junction. Determined by Prof. Cockerell. The hind wings of all the specimens are deep blue bordered with black and correspond exactly to Cockerell's description (Ent. News, 1902, p. 305.) The closely allied species, *wheleri*, we have not taken in the State.

DISSOSTEIRA Scudder.

- carolina** Linn. Generally distributed over the State up to an altitude of about 8,000 feet. Adults taken from July 8th (Pali-sades) to Sep. 25 (Pueblo). Locations of capture: Ft. Collins, Laporte, Va. Dale, Dutch George's, Greeley, Orchard, Boulder, Pueblo, LaJunta, Lamar, Holly, Alamosa, Durango, Mc-

Elmo, Antonito, Cortez, Grand Junction, Delta, Hotchkiss, Paonia, Glenwood Springs, and Estes Park.

longipennis Thom. A common species east of the foothills, particularly in the southern portion of the State where it extends west into the foothills. It is very rarely that a specimen is seen at Ft. Collins. It is a common insect at the electric lights in Denver and at Colo. Springs. The college specimens are from Fort Collins, Greeley, Snyder, Sterling, Ft. Morgan, Denver, Pueblo, Canon City, Rockyford, Las Animas, LaJunta, Lamar, and Holly.

SPHARAGEMON Scudd.

aequale Say. A fairly common species in eastern Colorado and extending a short distance into the foothills. Our specimens come from Ft. Collins, Ft. Morgan, Boulder, Colorado Springs, Rockyford and LaJunta. The dates of capture are from July 8th to Sep. 14th. Large females have a striking resemblance to *Hadrotettix trifasciatus*.

collare Scudd. Our specimens, few in number, have been taken at Ft. Collins, Greeley, Orchard and Pueblo. A few of the Ft. Collins specimens were taken a mile or two back in the foothills. The dates range between July 10th and Oct. 3d.

cristatum Scudd. We have but few captures of this species, coming mostly from the eastern and southern portions of the State. The localities are Ft. Collins, Wray, Pueblo, Rockyford, Lamar, and from Stratton in Nebraska.

humile Morse. This is one of the most common species in the northern and eastern portions of the State. According to our collections it extends into the mountains to an altitude of about 9,000 feet. The captures are from the following points: Ft. Collins (both plains and foothills), Livermore, Dutch George's, Sterling, Ft. Morgan, Snyder, Wray, Orchard, Denver, Pine-wood and Buena Vista. The dates of capture range between July 8th (Ft. Collins) and Sep. 19th (Buena Vista). The specimens that I am referring to this species seem hardly to be specifically distinct from *aquale*.

pallidum Morse. Along with the typical light colored specimens belonging to this species as determined for me by Prof. Bruner and Prof. Morse I have included a number of darker color that seem in every other way to be identical. The specimens before me came from the following points: Ft. Collins, Laporte, Greeley, Julesburg, Orchard, Denver, Pueblo, LaJunta, Lamar, Rifle and Delta.

DEROTMEMA Scudder.

haydeni Thos. This is a very common species throughout the State up to an altitude of about 9,000 feet. Light colored specimens that seem to be the true *cupidincum* of Scudder seem to me to grade insensibly into true *haydeni*, so I am including all under this name. Mr. Caudell distinguished *cupidincum* by the narrower black band of the wings which does not seem to hold true in all the spread specimens I have examined.

The 100 and more specimens of the College collection come from the following localities: Ft. Collins, Laporte, Livermore, Dutch George's, Julesburg, Ft. Morgan, Orchard, Sterling, Greeley, LaSalle, Lafayette, Denver, Boulder, Palmer Lake, Colorado Springs, Glenwood Springs, Pueblo, Rockyford, Las Animas, LaJunta, Lamar, Trinidad, Canon City, Salida, Buena Vista, Rifle, Colorado Springs, Gunnison, Antonito, Durango, Dolores, Delta and Grand Junction.

MESTOBREGMA Scudder.

thomasi Caud. (*cinctum* Thos.) Eight specimens collected from the following points: Colo. Springs, Pueblo and Nepesta. Dates range from July 19th to Sep. 25th.

klowa Thom. A very common species on native grasses over the State generally, occurring in the mountains up to an altitude of fully 10,000 feet. Caudell reports having taken this species on the summit of Pike's Peak. The College collection of over 200 specimens came from Ft. Collins, Livermore, Dutch George's, Va. Dale, Julesburg, Sterling, Merino, Wray, Greeley, Windsor, Boulder, Denver, Colo. Springs, Pueblo, Palmer Lake, Rockyford, Las Animas, Trinidad, Ridgway, Antonito, Durango, Gunnison, Alma, Rifle, Estes Park, Steamboat Springs, Dunkley, Hamilton and Hayden. Dates of capture July 2nd to Oct. 9th.

mexicanum Sauss. Our 30 specimens of this robust species came from Ft. Collins, Dutch George's, Palmer Lake, Pueblo and Trinidad. Dates, Aug. 13th to Oct. 9th.

plattei Thom. A rather common species over the plains of the eastern portion of the State and occurring in the lower regions of the eastern slope to an altitude of 8,000 feet. The College specimens are from Ft. Collins, Dutch George's, Sterling, Wray, Home, Pinewood, Boulder, Colo. Springs, Pueblo, Rockyford, Nepesta, Las Animas, Lamar, Trinidad and Antonito. The dates range between July 8th and Sep. 3.

pulchella Bruner. (Determined by Prof. Bruner). Our 30 specimens of this beautiful green and black species are in the collection

from Ft. Collins and Va. Dale and one from Kimball, Neb. Dates, July 17 to August 16.

METATOR.

pardalinus Sauss. This is a common species in the vicinity of Ft. Collins. The College specimens are from Ft. Collins, Va. Dale, Dutch George's, Sterling, Steamboat Springs and Boulder. Dates range between June 28th and Sep. 12th.

There are 14 females and 6 males with red wings, and 14 females and 16 males with yellow wings.

CONOZOA Saussure.

gracilis Thos. The 55 specimens of this species in the College collection are all from the mountains except a specimen from Greeley and one from Pueblo. The localities of the captures are Greeley, North Park, Pueblo, Alder, Alamosa, Durango, Cortez, Dolores, Gunnison, Rifle, Paonia, Grand Junction, Steamboat Springs, Walden, Maybell, Hamilton, Glendevy, Lay, Dunkley and Craig.

TRIMEROTROPIS Stal.

azurescens Brun. A few specimens of this blue-winged species have been taken at Rifle, Paonia, Delta, Steamboat Springs and Hamilton, on the most barren hill-sides. July 25th to Sep. 23d.

agrestis McNeill. Specimens of this species as determined for me by Prof. Bruner come from Julesburg, Orchard, Greeley, Rockyford, LaJunta and Lamar.

bruneri McNeill. This is a common species on the northern plains of the State. In general appearance and markings it is wonderfully like *Hadrotettix trifasciatus*. The females are about the size of the males of that species. Specimens in the College collection are from Ft. Collins, Greeley, Ft. Morgan, Sterling, Pueblo, LaJunta and Antonito.

cineta Thom. There are 36 females and 59 males of this species in the collection and all came from the mountains or foothills of the State. Without exception the hind tibiae are bluish or yellowish with a dusky patch a little beneath the knees in just the position to meet the black spot in the sulcus of the under surface of the femur. There are several specimens marked Ft. Collins in the collection but all came from Horse-Tooth mountain, a high foothill about 8 miles south-west of town. Our specimens have been taken at altitudes ranging between 6,000 and 10,000 feet and from both slopes.

citrina Scudd. A common and one of the very largest species that we have taken. I am including under this name forms that

seem to go well under *laticincta* and *latifasciata* but for which I am unable to find specific characters different from what I am calling *citrini*. Our specimens have been taken at the following places: Ft. Collins, Greeley, Va. Dale, Dutch George's, Ft. Morgan, Livermore, Pueblo, Rockyford, LaJunta, Lamar, Dolores and Durango. June 16 (Rockyford) to Oct. 6 (Ft. Collins.)

inconspicua Bruner. (See description in article following this).

monticola Sauss. A common species along the eastern foothills and extending across the plains in the northern portion of the State. It also occurs in the mountains of the central portion of the State to an altitude of 9,000 feet. Specimens taken at Ft. Collins, Livermore, Dutch George's, Va. Dale, Estes Park, North Park, Greeley, LaSalle, Colo. Springs, Ft. Morgan, Palmer Lake, Trinidad, Alder, Canon City, Buena Vista, and from Tie-Siding in Wyoming. Dates of capture, June 18 (Palmer Lake) to Sep. 18 (Palmer Lake).

montana McNeill. Five specimens of this species came from Durango, Grand Junction and Delta. July 28th to Sep. 23d. (Determined by Prof. Bruner and by Prof. Morse).

obscura Scudd. A few examples of this species all from mountainous districts: Palmer Lake, Salida, Antonito, Silverton (12,000 ft.), Pike's Peak at 11,000 ft. (Cockerell), Steamboat Springs, Pagoda, Hamilton, Hebron and Lay.

vinculata Scudd. A common species across the southern portion of the State and occurring as far north, at least, as Ft. Collins. The localities of our captures are: Ft. Collins, Greeley, Pueblo, Colo. Springs, LaJunta, Nepesta, Lamar, Durango, Cortez, Dolores, Antonito, Alamosa, Palisades, Delta, Steamboat Springs, Craig, Maybell and Hamilton. Dates of capture are between June 15th (Pueblo) and Oct. 8th (Salida).

In this lot are a few specimens that I kept separate for a time as *similis*, but as the number of specimens increased the two forms seemed to run together. (Since writing the above the examples supposed to be *similis* have been determined for me by Prof. Morse as a form of *vinculata*).

CIRCOTETTIX Scudder.

carlinianus Thom. The specimens in the College collection are mostly from the vicinity of Ft. Collins. Other localities of capture are: Livermore, North Park, Dunkley, Palmer Lake, Colo. Springs, Durango, Grand Junction and Gunnison. Dates, June 26th to Oct. 4th at Ft. Collins.

suffusus Scudd. This very dark slender species we have taken in the foothills only, chiefly of the western slope, and in altitudes ranging between 7,000 and 8,000 feet. The males are very noisy with their wings. Rather common. Points of capture: Walden, Steamboat Springs, Dunkley, Estes Park, Palmer Lake, Durango, Hamilton and Pagoda.

undulatus Thom. Our examples of this species are from Ft. Collins, Dutch George's, Wray, Pueblo, Hague's Peak, Manitou, and Rifle; July 13th to Sep. 10th.

verruculatus Kirb. A mountain species which we have found more common in the middle and southern portions of the State. Our specimens are from Ft. Collins (foothills), Estes Park, Golden, Ward, Palmer Lake, Salida, Marshall Pass, Pike's Peak, Buena Vista, Paonia, Delta, Durango, Dolores, Rico, Steamboat Springs, Pagoda, Dunkley and Hamilton. Dates of capture, July 13th (Palmer Lake) to Oct. 8th (Salida).

HADROTETTIX Scudder.

trifasciatus Say. A common species over the native grass lands of the eastern portion of the State and extending some distance within the foothills. Some of the College specimens came from fully 8,000 feet altitude. Localities: Ft. Collins, Dutch George's, Livermore, Pinewood, Greeley, Wray, LaSalle, Sterling, Golden, Pueblo, Canon City, Rockyford, LaJunta, Lamar, Holly, Antonito and Salida. Dates, July 10th to Oct. 10th (Ft. Collins).

PARAPOMALA Scudder.

cyindrica Brun. This species probably occurs over the greater portion of the eastern plains of the State and in the lower foothills, where blue-grass, *Agropyrum glaucum* grows, which seems to be the chief food-plant. Localities of capture: Ft. Collins, (plains and foot-hills), Windsor, Orchard, Snyder, Julesburg, LaSalle, Rockyford, Las Animas and Lamar. Adults June 16th to Sep. 14th at Rockyford. We also have specimens from Stratton, Neb. (Ball).

Both green and brown forms occur throughout the range. I see no way to distinguish this species from *wyomingensis* Thos.

BRACHYSTOLA Scudder.

magna Gir. This very large species, commonly known as the "lubber" is quite common over the eastern plains to the foothills. It also occurs some little distance inside the hills in open grassy areas. We have noted it feeding upon American laurel, *Kalmia glauca*, and upon groundsel, *Senecio* sp. (Ball). The

males in the collection measure between 43 mm. and 61 mm., and the females between 45 mm. and 61 mm. in length.

The earliest we have found adults at Ft. Collins was July 10, 1901, and then only a single specimen could be found. On the 22d of the month adults were common and mating had begun. On Aug 1st of the same year some had begun to lay eggs and on Sep. 5th adults were common and several pairs were seen *in coitu* (Ball). Egg-laying begins about Aug. 1st.

In the males of this species the short wings are approximate or even overlapping on the back while in the females they are always widely separated.

SCHISTOCERCA Stal.

albolineata Thomas. What I am considering as this species are very closely related to the preceding, the only striking difference being the coral red hind tibiæ. There are specimens from Ft. Collins, Windsor, Timnath, Greeley, Merino, Orchard, Sterling, Julesburg, Nepesta, Rockyford, Lamar, Holly, Glenwood Springs, Grand Junction, Delta and Durango in the collection. The examples from the last four places named lack the black spots on the hind margins of the abdominal segments and have the hind tibiæ lighter red in color. The elytra are not noticeably darker bordering the yellow stripe and the notch in the subgenital plate of the male is U-shaped, being broader than deep. Specimens from Delta and Grand Junction were taken from willows and from apple and peach trees. When disturbed they would take wing and fly from tree to tree. It is very likely these belong to a different species than the specimens from the eastern slope.

lineata Thom. This species occurs entirely across the State from north to south, east of the mountains. It occurs along water courses and seems to be arboreal in habit.

The males vary between 30 mm. and 35 mm. in length to tip of abdomen, and between 36 mm. and 43 mm. to tips of elytra. The females vary between 35 mm. and 48 mm. to tip of abdomen and between 42 mm. and 57 mm. to the tips of the wings.

The species varies very much in coloration; some are very pale yellow, others are yellowish green, and still others are of a rusty yellow. All have the hind tibiæ black behind and yellow before.

The earliest we have taken adults at Ft. Collins was July 10, 1899. Specimens have been taken as late as Sep. 5th at the same place and as late as Sep. 14, 1898 at Rockyford.

Specimens have been taken at Ft. Collins, Windsor, Greeley, Merino, Julesburg, Orchard, Manitou, Nepesta, Rockyford, Lamar, Holly and Trinidad.

HYPOCHLORA Brunner.

alba Dodge. This is a common species over the plains region of Colorado where its food plants occur. The two species upon which it chiefly occurs are *Artemisia frigida* and *A. ludoviciana* (white sage). It is not readily seen among the leaves of these plants which it closely imitates in color. The colors vary from a pale yellowish green to a rusty brown.

A large number of specimens in the College collection vary between 15 mm. and 19 mm. in length in the males, and between 21 mm. and 25 mm. in length in the females. The short pointed elytra measure between 4 mm. and 5 mm. in length in the males and between 5 mm. and 6½ mm. in the females. So far as known this insect attacks no cultivated plant.

Adults have been taken as early as July 8, 1898, at Ft. Collins and as late as Oct. 14th, 1901, at the same place. It has also been taken at Denver, Boulder and Julesburg, Colorado, and at Kimball, Nebraska.

CAMPYLACANTHA Scudder.

olivacea Scudd., seems to occur in the south-eastern portion of the State only. Several specimens were taken Sep. 8, 1898, at Holly, and others at Trinidad four days later, all by E. D. Ball.

This grasshopper is said to be partial to sunflower (*Helianthus*), and to lamb's quarter (*Chenopodium*), and Bruner suspects it of feeding upon beets also.

The 21 males in the College collection vary between 18 mm. and 22 mm. in length and the tegmina vary between 5 mm. and 7 mm. The 28 females vary between 22 mm. and 29 mm. in length and the tegmina vary between 5 mm. and 8 mm.

HESPEROTETTIX Scudder.

coloradensis Brun. (See description in article following this).

gillettei Brun. (See description in article following this). This seems to be a rare species in Colorado. After considerable searching I took five specimens from *Gutierrezia euthamiae* at Glenwood Springs Sep. 15th, 1903. The collection also contains specimens from Delta, Grand Junction and Rifle, all points upon the west slope. July 13th to Sep. 16th.

pratensis Scudd. This is a fairly common, though not an abundant species over the plains and lower foothills of eastern Colorado. It seems to be of no economic importance as we have only recorded it feeding upon sunflower (*Helianthus*).

Our earliest were taken at Ft. Collins, July 6th, 1901, and our latest were taken at Greeley, Oct. 3, 1902. At Rockyford, July 16, 1901, this species was just becoming adult upon sunflowers. (Ball). At Ft. Collins on June 26 of the same year the nymphs were noted as being one-third grown (Ball).

We have made captures of this insect at the following points in the State: Ft. Collins, Livermore, Dutch George's, Home, Julesburg, Merino, Wray, Bald*Mt., Boulder, Golden, Palmer Lake, Colorado Springs, Lamar and Holly; also at Kimball and Stratton, Nebraska (Ball).

The greatest altitude at which we have taken this species is between 7,000 and 8,000 feet.

speciosus Scudd. This species occupies the same regions, practically as *pratensis*. It extends over the entire eastern portion of the State to the foothills and we have taken specimens at an elevation of somewhat over 6,000 feet in the hills.

The native food-plants of this species are sunflower (*Helianthus*) and a closely related composite, *Iva xanthifolia*. It is a much more abundant grasshopper than *pratensis*.

This species has been taken at the following places: Ft. Collins, Livermore, Dutch George's, Sterling, Julesburg, Orchard, Wray, Greeley, Merino, Pueblo, Rockyford, Las Animas, Nepesta, Lamar and Holly.

The 34 males in the collection vary between 20 mm. and 26 mm. in length, and the 66 females vary between 25 mm. and 34 mm. The wings are variable in length but in the great majority of cases they fall a little short of the tip of the abdomen in both sexes. Sometimes they are considerably shorter than the abdomen and occasionally they are slightly longer. The males above mentioned have wings varying between 20 mm. and 26 mm. and the females have wings between 13 mm. and 24 mm. in length.

As this grasshopper feeds entirely upon native weeds it can not be considered of economic importance.

viridis Thom. This is one of the handsomest and most common of the plains species and occurs over all the eastern portion of the State up to the base of the foothills, where it is as abun-

*West of Loveland on Estes Park road.

dant as anywhere. It extends into the foothills for ten or fifteen miles in places and occurs as high as 7,000 feet in altitude, at least.

The native food plants are *Bigelovia* (rayless goldenrod) and *Gutierrezia euthamiae*.

We have records of this species in the following places within the State: Ft. Collins, Dutch George's, Windsor, Greeley, Sterling, Wray, Boulder, Denver, Colo. Springs, Pueblo, Rockyford, Las Animas, Lamar, Nepesta and Holly.

Adults have been taken as early as July 2, 1901, at Ft. Collins and they were still abundant and mating freely at the foothills west of the town as late as Oct. 8, 1902 (Ball).

This species has not acquired, an appetite for cultivated plants and its native food-plants are not of economic value.

PODISMA Latreille.

sodget Thom. This is distinctly a mountain species. We have taken it from just inside the first foothills at an altitude of 5,500 feet to 12,000 feet altitude upon the mountains. From 8,000 to 10,000 feet it is a rather abundant species. Food-plants unknown.

We have taken this species at the following Colorado points: Ft. Collins (foothills), Livermore, Dutch George's, Home, Ward, North Park, Lizard Head, Pike's Peak 12,000 feet (Cockerell) and Rico, as well as at several intermediate mountain points.

We have taken adults as early as June 12, 1900, near Ft. Collins and as late as Sep. 28th, 1898 in the same locality.

The 75 males in the collection vary between 14 mm. and 19 mm. in length and the 95 females between 21 mm. and 32 mm. The wings of the males vary between 4.5 mm. and 6.5 mm. and those of the females vary between 6 mm. and 8.5 mm.

stupfacta Scudd. Seventy-three males and 80 females of this species were taken by Mr. Charles Jones above timberline near Silverton, Colo., during August, 1903. He found this by far the most abundant grasshopper above 12,000 feet altitude in that vicinity. The hind tibiae are universally red.

AEOLOPLUS Seudder.

chenopodii Brun. Taken at Grand Junction July 7, 1901, July 29, 1901, and Aug. 29, 1899; Palisades July 8, 1901, and Delta Sept. 23, 1901. The food-plant is a common species of *Atriplex* that is native upon the unirrigated ground in the neigh-

borhoods where the grasshoppers were taken. This species has been found fairly common about its food-plant. Upon being disturbed the hoppers jump in among the bunches of weeds and fall to the ground where they remain motionless for a time and are found with some difficulty as their color blends readily either with the food-plant or the ground.

The males vary between 14 mm. and 16 mm. and the females between 16 mm. and 22 mm. in length. The short elytra of the males vary little from 2 ½ mm. and those of the females vary little from 3 ½ mm. in length. Twenty-five males and 32 females examined.

minor Brun. (See description following this article).

plagosus Scudd. A few specimens of this species were taken at Delta, Colo., July 13, '01. They were fairly common on *Sarcobatus* sp. (greasewood), which was growing abundantly on seepage ground about the town. (Gillette.)

turnbulli Brun. This is a common species over the plains region of Colorado east of the foothills. Its chief food-plants are species of *Atriplex* and Russian thistle. It has been seen feeding upon *Cleome* where its common food-plants were very scarce. *Atriplex expansa*, *A. canescens* and white sage, *Eurotia lanata*, have been specially noted as food plants of this insect.

We have taken this species at the following points in Colorado: Ft. Collins, Livermore, Julesburg, Sterling, Greeley, Ft. Morgan, Pueblo, Nepesta, Rockyford, Las Animas and Salida. The last named point is the only one any distance within the foothills where we have taken this species and only occasional specimens could be found there.

The Colorado specimens range rather larger in size than the types described by Prof. Bruner. The large number of specimens in the College collection measure as follows: Males between 17 mm. and 20 mm.; females between 17 mm. and 25 mm. The elytra vary somewhat in length but in nearly all cases they exceed the tip of the abdomen in both sexes. We have taken several females with short elytra, about 7 mm. in length, but have taken no short-winged males.

Adults have been taken from June 16 (Rockyford) to October 8 (Ft. Collins). The earliest that adults have been taken at Ft. Collins is June 26.

At the latest date mentioned, Oct. 8, many of the females still had immature ova of the second crop. (Ball.) Fourteen females were dissected Aug. 19th and only three seemed to have deposited their first batch of eggs. (Ball.)

This species, feeding almost exclusively upon weeds, can not be considered injurious at present and is not likely to become so unless it turns its attention to sugar beets which are closely related to the weeds upon which the hopper feeds.

MELANOPLUS Stal.

alpinus Brun. Taken between North Park and Cameron Pass, Aug. 20, 1899. (Ball.)

angustipennis Dodge. A single male answering the description of this species has been taken at Colorado Springs, Colo. It is indistinguishable from numerous specimens of *M. coccineipes* except for the blue hind tibiae. It seems probable that *coccineipes* is a red-legged var. of *angustipennis*.

atlanis Riley. This is undoubtedly the most generally distributed species of locust in Colorado. It may almost be said to occur everywhere up to an altitude of 8,500 feet. Adults may be seen from about the 20th of June until after there have been several heavy frosts in the fall. This species is extremely variable in size and coloration. The lighter colored individuals have head, body and legs, except hind tibiae, pale yellowish to rusty brown in color and even the elytra may partake of the color to a considerable extent. The latter may be conspicuously flecked with dusky spots or the dark spots may be entirely wanting. The light colored specimens are more prevalent in the lower warmer areas and early in the season and it is in the lower altitudes that the species attains its largest size. Specimens taken at 7,000 feet altitude and higher are nearly all small, dark-colored and without distinct markings. A common range in size between the small dark males of high altitudes and the larger ones of the eastern portion of the State is from 16.5 mm. to 26 mm., and the females range between 22 mm. and 27 mm. This insect does its injuries very largely to the native pastures though it is not averse to feeding upon various cultivated crops. It is certainly one of the most destructive grasshoppers to the native range pastures of the State.

At Ft. Collins, adults have been taken from June 22nd to November 11th. Many of the females taken on the latter date, 1902, still contained their second pod of eggs undeposited (Gillette). On July 26, 1901, a number of females were dissected at Ft. Collins and none of them had the first pod of eggs sufficiently matured for deposition (Ball). This species is evidently single brooded.

We have taken this species at the following points within the State: Ft. Collins, Laporte, Dutch George's, Liver-

more, Stove Prairie, North Park, Pike's Peak at 1,000 feet (Cockerell), Windsor, Greeley, Merino, Wray, Ft. Morgan Julesburg, Boulder, Lafayette, Denver, Palmer Lake, Canon City, Nepesta, Rockyford, Lamar, Holly, Trinidad, Colorado Springs, Salida, Buena Vista, Gunnison, Delta, Paonia, Grand Junction, Palisades, Durango and Steamboat Springs.

It seems probable that some of the reported occurrences of *Melanoplus spretus* should have been referred to this species.

bivittatus Say. This is undoubtedly the most injurious grasshopper in Colorado. It is doubtful if any insect causes heavier annual loss to the State. It is nearly, and perhaps quite as widely distributed as *femur-rubrum*. Its large size and great numbers and its appetite for cultivated plants of nearly every kind, make it very destructive. It is especially numerous in the alfalfa fields of the irrigated region near the foothills. Towards the eastern border of the State it is often outnumbered by *differentialis*. It is also abundant in the alfalfa and grain fields of the western slope and sometimes defoliates fruit trees when orchards are not kept cultivated or when they are alongside of alfalfa or pasture land.

This species is capable of subsisting upon almost any cultivated crop. We have noted the following food plants: Alfalfa, red clover, grass, corn, wheat, oats, barley, fruit trees in general, cabbages, beets, potatoes and onions.

It has a strong tendency to climb tall plants and fence posts to rest for the night. The injuries are usually worst about the borders of fields.

There is comparatively little variation in the coloration of this species. The two yellow lines upon the elytra seem always to be present as a distinguishing characteristic; the head and pronotum are occasionally almost entirely pale yellow in color. In size and in wing-length this species varies widely. Males of long winged specimens vary between 21 mm. and 33 mm. in length and the females between 27 mm. and 41 mm. The majority of the specimens have elytra exceeding the tip of the abdomen but individuals with abbreviated wings are common and it is not very infrequent that they do not cover more than two-thirds of the abdomen. There are small males in the collection with elytra only 7.5 mm. long. As in *femur-rubrum*, the short winged individuals average smaller than those having long wings.

The earliest we have taken adults at Ft. Collins was June 12, 1900. June 21, 1901, a single male was found, and on

the 26th of the same month adult males were quite common (Ball). There is but one brood, as with all our *Melanopli*, but many of the eggs hatch late so that small nymphs are seen after many are adults. November 11, 1902, numerous females were seen at Ft. Collins and some of these had ova that were still immature (Gillette). Sept. 2, 1902, at Ft. Collins, occasional nymphs were seen and dissection of adult females showed that only about half of them had deposited the first pod of eggs. (Ball.)

We have recorded the species from the following places: Ft. Collins, Laporte, Livermore, Steamboat Springs, Eddy, Greeley, Sterling, Merino, Julesburg, Denver, Golden, Colorado Springs, Pueblo, Canon City, LaJunta, Rockyford, Lamar, Salida, Alder, Antonito, Delta, Grand Junction and Palmer Lake.

All the specimens in the collection have blue hind tibiae and I do not remember certainly to have seen the form (or species) with red hind tibiae in Colorado. It seems to me I have, but if so, the red-legged ones are only of occasional occurrence.

bowditchi Scudd. A common species in the southern portion of Colorado east of the foothills, and occurring in small numbers in the northern portion also. In the north it is largely replaced by a closely allied species *M. flavidus*. It is distinctively a plains species, and, so far as is known, confines its injuries to the native plants. We have found this species specially abundant along the Arkansas valley. Our dates of capture range between June 17th, 1900, at Lamar and Sept. 10th, 1898, in the same place (Ball). Food-plants unknown.

The males vary between 22 mm. and 25 mm. and the large females measure 30 mm. This species is readily separated from *flavidus* by its shorter antennae (only 11 mm. long in the males) and by the presence of the black post-ocular band. It is also smaller and less robust as taken in Colorado. The fucula vary much in form at their tips. They may be truncate, cut diagonally, rounded, or slightly hooked, and two of these forms may occur on the same grasshopper.

Taken at the following places: Ft. Collins, LaSalle, Greeley, Timnath, Rockyford, Lamar and Colorado Springs, also at Kimball and Stratton in Nebraska. (Ball.)

coccineipes Scudd. This species occurs in moderate numbers over the entire plains region of Colorado and extends for some distance into the foothills. It varies in color from a dark

fuscous brown to almost a uniform and rather light rust-yellow. The lighter colored specimens occur mostly in the southern portion of the State. The post-ocular stripe varies from a broad and distinct black band to none. The subgenital plate is usually notched but in some specimens it is truncate. It seems quite probable to me that this species is nothing more than a form of *angustipennis* having red hind tibiae.

The males we have taken vary between 19 mm. and 24 mm. in length. The females resemble allied species so closely that it is difficult or even impossible to distinguish them.

The only native food-plant we have recorded for this species is *Artemisia filifolia*. We have also taken it common on alfalfa and on young apple and plum trees.

Specimens have been taken at the following places: Ft. Collins (common), Laporte, Livermore, Dutch George's, Timnath, Greeley, Orchard, Julesburg, LaSalle, Boulder, Pueblo, Colorado Springs, Canon City, Lamar and Holly. Adult males and females have been taken at Ft. Collins as early as July 10, 1901, and as late as October 12, 1898.

comptus Scudd. We have a half dozen specimens of what seem to be *M. coccineipes* except that the furcula are nearly straight and but little diverging. So, while I should consider these as varieties of *coccineipes* I list them here because they seem to correspond better with the form that has been described as *comptus*. The specimens were all taken near Ft. Collins where we have done most of our collecting for *M. coccineipes*.

conspersus Scudd. This species occurs over the eastern plains and in the mountain parks of the eastern slope to an elevation of something over 8,000 feet. The species was found fairly common, for example, near Alder at an altitude of 8,500 feet on native grass land. It occurs most abundantly, however, on the grassy slopes of the foothills and upon the plains just outside the hills. While this locust has been found chiefly upon native grass-pasture land it has also been noted as feeding upon cabbages and alfalfa in moderate numbers. So the species is doubtless capable of adapting itself to a diet of cultivated plants if its supply of native food-plants should run short. It probably causes considerable damage where abundant upon native pasture land.

Our earliest capture of an adult of this species was at Greeley, July 13, 1898. But very few adults have been taken before Aug. 5th. Our latest capture was at Julesburg, Nov. 8, 1902.

We have taken specimens at the following points: Ft. Collins, Livermore, Windsor, Greeley, Julesburg, Boulder, Denver, Palmer Lake, Pueblo, Trinidad, Antonito, Alder, Salida and Buena Vista; and at altitudes varying between 4,500 and 8,500 feet. The high altitude specimens are smaller in size, darker in color and could easily be taken for a different species from the brownish testaceous form found in the lower altitudes.

The small males from high altitudes measure as small as 16 mm. in length while the largest from lower altitudes measure as high as 24 mm. The females measure between 18 mm. and 27 mm.

cuneatus Bruner. See *Melanoplus occidentalis*.

dawsoni Scudd. Our collections indicate that this species is confined to the foothills of the eastern slope of the mountains. It is not an abundant species but we have taken it from the border of the plains next the first foothills to an altitude of 8,000 feet. Specimens have been taken as far south as Palmer Lake. It is most common on the dry slopes of the lower foothills. The long winged form has not been taken.

Males vary in length between 14 mm. and 17 mm. and their elytra between 4.5 mm. and 6 mm. The females vary in length between 18 mm. and 20 mm. and their elytra between 5 mm. and 7 mm. Measurements upon 25 males and 31 females.

Specimens have been taken at Ft. Collins (at foothills), Dutch George's, Steamboat Springs, Pinewood, Boulder and Palmer Lake.

devastator Scudd. Two locusts taken at Steamboat Springs July 26th, 1891, were determined by Dr. Scudder as belonging to this species with a question mark attached. Altitude about 7,000 feet.

differentialis Uhl. This is an abundant and very destructive species in the lower altitudes of the State, especially where there is plenty of moisture. Except for the black markings of the posterior femora this species has no conspicuous markings but it varies much in color. In the warmer portions of the State the prevailing color is a light yellowish brown while in the higher and cooler portion the prevailing color is very much darker. In all places where the species occurs in the State there are occasional or frequent individuals that are black, except for yellow bands upon the legs, and sometimes light posterior lateral margins to the pronotum.

This locust is a very general feeder, particularly upon cultivated plants. Those we have noted are: alfalfa, corn, Kaffir corn, wheat, oats, leaves of apple, peach and plum and sugar beets.

The males taken vary between 27 mm. and 35 mm., and the females vary between 31 mm. and 42 mm. We have recorded the species from the following places: Ft. Collins, Windsor, Greeley, Merino, Julesburg, Loveland, Sterling, LaPorte, Boulder, Pueblo, Colorado Springs, Canon City, Las-Animas, Rockyford, Lamar, Delta and Grand Junction. This species has been most abundant along the eastern portion of the State and at Grand Junction. We have not taken specimens above 5,500 feet altitude.

This species is rather late in maturing. A few adults were seen at Pueblo July 15th, 1901, and a few at Rockyford July 16th 1901 (Ball). The earliest adults at Ft. Collins were taken July 21, 1901. At Merino Aug. 8, 1902, females were not ready to oviposit. Females taken Nov. 11, 1902, still contained immature ova.

dimidipennis Brun. (See description following this article).

fasciatus Barnst. This species appears to be confined to the mountains and chiefly to high altitudes. Our specimens have come from two locations, Marshall Pass and Ward, at altitudes varying between 10,000 and 11,000 feet, except a single specimen taken in the foothills a few miles west of Ft. Collins at an altitude of 8,000 feet. I wonder if this mountain species can be identical with the *fasciatus* of the New England states. It is certainly a native of the high mountain ranges in Colorado where it occurs very sparingly.

The males vary between 15.5 mm. and 18 mm. in length and the females between 18 mm. and 21 mm.

All the specimens taken are short-winged, belonging to variety *curtus*.

femor-rubrum DeGeer. This is, next to *allanis*, the most generally distributed of any species of *McLanoplus* in Colorado. Next to *bivittatus*, it is probably the most injurious species though *differentialis* is more injurious where it is most abundant. It occurs on both the eastern and the western slopes and in the mountains to an altitude of 8,000 feet. The species is extremely variable in color. The almost unicolorous fuscous-brown form that is common in the eastern states is not the prevailing form here. The abdomen and all of the under surface is usually distinctly yellow. The lower part of the

face, an area at the base of each antenna, a patch beneath and posterior to the compound eyes and a narrow line above each black post-ocular stripe, and often the posterior portion of the occiput, also, are yellow. Sometimes the entire head, except the compound eyes, the vertex and the post-ocular stripes, is yellow. The pronotum may be entirely dark fuscous with a broad black band on the prozona on either side, or the sides of the pronotum may be partly or entirely yellow outside of the black band of the prozona. The disk of the pronotum may be entirely yellow, or entirely rufous or it may be dark at the sides with a yellow or rufous median stripe of varying breadth. The femora may be yellowish shaded with dusky or they may be distinctly tinged with red. The hind femora may be dusky brown above with the lower half of the outer face yellow, or the outer face may be dusky brown throughout. In others the outer face is dusky brown with a yellow or even a reddish margin. In still others, and these are not uncommon, the dark parts of the femora are blue or bluish-green in color. In some the color is a deep steel blue. When these blue colors occur on the femora, the dark parts of head, thorax and elytra partake of the same tint. Those most highly colored with the blue often have the hind tibiae tinted with the same color. These highly colored forms are among our handsomest grasshoppers and seem at first quite unlike the somber colored *femur-rubrum* as commonly described and seen in the east and yet there is so complete a gradation of forms between the extremes of coloration that I have not been able to separate out a distinct variety. It seems probable that these blue colored forms are what Dodge described as *plumbeus*. In fact he suggests that *plumbeus* may be only a local variety of *femur-rubrum*. At least I have been unable to find any characters that will hold to separate typical form of *plumbeus* from these highly colored forms of *femur-rubrum*.

The males we have taken vary between 17 mm. and 26 mm. in length and the females between 20 mm. and 26 mm. These are common variations. Occasionally a specimen is taken that seems abnormally small. This is especially true of occasional short-winged specimens that we have taken.

Short-winged form. We have taken specimens of a short-winged form of this species, mostly in shaded places. The elytra in these have been between 6 mm. and 7 mm. in length and reach a little beyond the middle of the abdomen. The males of this form have measured between 12 mm. and 16 mm. in length and the females about 18 mm. These were mostly taken by Prof. Ball.

The above is written up from 190 males and 100 females of the long-winged form and seven males and one female of the short-winged form.

The food-plants we have recorded for this species are: alfalfa, wheat, oats, corn, potatoes, beets, foliage of fruit trees and cabbage.

We have taken specimens at the following places: Ft. Collins, Laporte, Livermore, Virginia Dale, Windsor, Greeley, Merino, Ft. Morgan, Julesburg, Snyder, Orchard, Boulder, Denver, Palmer Lake, Pueblo, Canon City, Colorado Springs, Las Animas, Rockyford, Lamar, Antonito, Salida, Gunnison, Ridgway, Delta, Paonia, Grand Junction, Palisades and Hayden.

The earliest that an adult has been found at Ft. Collins was June 26, 1901, (Ball). Ordinary years very few adults can be found before the 15th of July. Females taken Nov. 11, 1902, still contained immature ova.

flabellifer Scudd. See *occidentalis*.

flabellifer var. *brevipennis*. See description in following article.

flavidus Scudd. This is also a plains species and occurs sparingly in the southern portion of the State. It is abundant upon grass pastures along the foothills and upon the plains near Ft. Collins and has been taken feeding upon alfalfa, cabbages, leaves of plum and cherry trees and upon *Artemisia trifolia*, so that, whenever a food supply of native plants becomes scarce, this species is likely to become seriously injurious to cultivated crops.

This species is somewhat larger than *bowditchi*, the males ranging from 23 mm. to 26 mm. in length and the larger females measure as much as 32 mm. The antennæ of the males measure 14 mm. These dimensions are somewhat greater than those given for the types. We have taken adults at Ft. Collins from July 19th, 1902, till Sept. 19th, 1898.

Taken at the following points: Ft. Collins, Timnath, Greeley, Julesburg, and a single specimen at Lamar.

The furculæ of the male vary about the same as in *bowditchi*.

gillettei Scudd. Marshall Pass, Aug. 23, 1896 (Ac. 2260), and Aug. 27, 1899; Cameron Pass, Aug. 19 and 20, 1899; Little Beaver, July 17, 1898.

This species has been found at high altitudes only. It was fairly common Aug. 27th on Marshall Pass between

11,000 and 12,000 feet altitude and was taken between 10,500 and 12,500 feet in altitude. Food-plants not known.

glaucipes Scudd. The collection contains 16 males and 22 females taken at Wray, Pueblo and Nepesta. The males vary between 17 and 20 mm., and the females between 20 and 27 mm. in length. See *Melanoplus simplex*.

infantilis Scudd. This is the smallest of our Melanopli and is a mountain and high plains species in this State. It seems to prefer grassy areas in exposed places and may commonly be found in the grassy mountain parks to an altitude of 8,000 feet at least. We have not seen the species much higher than this. The earliest adults at Ft. Collins were taken June 21st, 1901 (Ball). The latest we have taken the species is Oct. 12th, 1898.

Our specimens vary in size as follows: Males from 13 mm. to 19 mm. and females from 15 mm. to 21 mm.

We have taken specimens at Ft. Collins, Laporte, Livermore, Dunkley, Idlewild, Dutch George's, Virginia Dale, North Park, Denver, Palmer Lake, Pueblo, Alder, Estes Park, Durango and Gunnison, and at Kimball, Neb. It doubtless occurs east across the plains of the northern portion of the State.

It is hardly abundant enough to be considered an injurious species in Colorado.

kennicottii Scudd. Marshall Pass, Aug. 27, 1899; Durango, Aug. 7, 1899; Chama (N. M.), Aug. 8, 1899; Ward, Aug. 30, 1899. The lowest we have taken this species was at about 6,500 feet at Durango. At Chama, (N.M.), it was taken at the station, 7,863 feet, while at Ward and at Marshall Pass specimens were taken between 10,000 and 11,000 feet altitude. The species has not been found abundant anywhere.

lakinus Scudd. This is distinctly a plains species occurring all over the eastern portions of the State to the first foothills. It is common on ground covered by native grasses upon which it is supposed to feed though we have no positive evidence upon this point. It has been noted as feeding upon sugar beets and Russian thistle (Ball) and is usually common where tumble-weeds grow.

The species occurs in both long-and short-winged forms, the latter being by far, more common. Out of the 225 specimens in the College collection there are 12 macropterous males and 7 macropterous females.

The males vary in length between 14 mm. and 23 mm. and the females between 20 mm. and 26 mm. The elytra in the brachypterous forms vary between 4 mm. and 7 mm. in length in both sexes.

The macropterous form has been taken at Ft. Collins, Julesburg, Holly and Pueblo. The short-winged form has been taken at Ft. Collins, Julesburg, Wray, Sterling, Greeley, Colorado Springs, Pueblo, Canon City, Trinidad, Nepesta, Rockyford, LaJunta, Lamar and Holly.

This species varies widely in size and coloration in Colorado. In some the yellowish-brown prevails, even upon the elytra and pronotum; in others a decided greenish-yellow tint occurs on the same parts. At the other extreme there are those that are quite uniformly dark fuscous so that even the dark bands of the femora are hardly discernable. I am unable to find any constant characters separating this species from type specimens of *M. maculatus* from Mexico that are in the College collection.

luridus Dodge. An abundant species in northern Colorado east of the mountains. It seems to be most numerous in the vicinity of the foothills but does not extend far into the hills. The native food-plant is *Artemisia dracunculoides*. The nymphs with their genæ and sides of the pronotum (except a white median line on the latter) black, make conspicuous objects upon the stems of the food-plant. This species takes readily to some of the cultivated plants also. We have noted it feeding upon alfalfa, cabbages and leaves of plum and apple trees.

In size the males vary between 19 mm. and 21 mm. and the females between 20 mm. and 26 mm. Measurements from 61 males and 24 females.

Adult males were just beginning to appear July 22 at Ft. Collins in 1901 (Ball). They were abundant at Laporte Sep. 30, 1899, and specimens have been taken at Ft. Collins as late as Oct. 23, 1901.

This species has also been noted as feeding upon *Bige-
lovia* (Ball).

But few females were ready to lay eggs Sep. 8, 1902 (Ball).

We have taken this species at the following places: Ft. Collins (abundant upon dry ground), Laporte, Livermore, Ft. Morgan, Colorado Springs and Boulder.

minor Scudd. This is not an abundant species in Colorado but occurs in moderate numbers in the north-eastern portion over

the plains and for a considerable distance into the foothills. In fact it seems to prefer the slopes of the lower foothills and the plains near them. We have found it in places rather common on alfalfa and have frequently noted the species upon blue-grass (*Agropyrum glaucum*) and rush-grass (*Sporobolus cryptandrus*).

This is also the earliest of the *Melanopli* to mature. We have taken adults fairly common at the foothills near Ft. Collins on June 6th, 1902 (Ball). The latest that we have taken adults is Aug. 22, 1902 at Ft. Collins. This species occurs as far south as Pueblo, at least. It has been taken at the following points: Ft. Collins, Laporte, Livermore, Julesburg, Wray, Denver, Palmer Lake and Pueblo.

Our males vary in size between 17 mm. and 20 mm. and the females between 23 mm. and 26 mm.

Specimens have been taken at an altitude of 7,000 feet in the foothills.

monticola Brun. Three males and one female from Windy Point, Pike's Peak, at an altitude of about 12,000 feet, Sep. 17th, 1903 (Cockerell).

occidentalis Thom. This is a common and wide spread species. It seems to occur over the entire plains region from north to south. It is common among the lower foothills and upon grassy areas in the mountains to an altitude of 8,000 feet, at least. In the lower altitudes the males vary commonly between 19 mm. and 22 mm. in length and the females between 19 mm. and 24 mm. Specimens taken at higher altitudes, as at Dolores, Durango and Buena Vista, are decidedly smaller and darker in color. The males from these higher altitudes measure between 15 mm. and 18 mm. and the females between 17 mm. and 19 mm.

Adults have been taken as early as June 17th at Ft. Collins, 1898, and at Lamar 1900 (Ball). At Ft. Collins there is very little mating before the first of August and males have been taken as late as September 12th. There is but one brood. Food-plant not known.

We have taken this species at Ft. Collins, Livermore, McCoy, Dutch George's, Wray, Sterling, Snyder, Greeley, Denver, Pueblo, Rockyford, Las Animas, Lamar, Trinidad, Buena Vista, Durango, Gunnison, Antonito and Dolores, and at Kimball and Stratton in Nebraska.

The cerci of the males of this species vary considerably in form, the extremes resembling very closely, if they

are not identical, with the forms described for *flabellifer* and *cuneatus*, but with such imperceptible gradations that I have been unable to recognize either of these species as separate from *occidentalis* in our collections.

The prevailing form of *cercus* in Colorado is that shown in Plate X, Fig. 6 of Dr. Scudder's "Revision of the Melanopli," and this is the form that agrees with Thomas' original description of *occidentalis*.

packardii Scudd. This is a common species over all the eastern portion of the State to the foothills and it also occurs in the grassy glades and mountain parks of the eastern slope to an altitude of 8,000 feet or more. It would be difficult to say whether the species is more abundant on the level prairie or upon the sides and summits of the low hills. It seems to be everywhere on land covered with native grasses, but that the grasses are its food-plants is an inference. This species is not uncommon in alfalfa fields and has been noted by us as feeding upon cabbages. The species is so large and abundant it must do considerable damage to native pasture land.

Males were just beginning to mature at Ft. Collins, June 29, 1901, and occasional adults were noticed in the same locality Oct. 8, 1902. (Ball.) Our adults were taken at Greeley June 24, 1899.

The species varies in Colorado from a light rusty brown to a rather dark brown with more or less distinct lighter stripes on the lateral margins of the dorsum of the pronotum. In some of the darker specimens these lines are obsolete.

In length, the males vary between 23 mm. and 29 mm. and the females between 23 mm. and 33 mm. Among the 127 specimens in the College collection there are 33 males and 21 females with blue hind tibiae and 36 males and 37 females with red hind tibiae.

This grasshopper has been taken in the following localities in Colorado: Ft. Collins, Dutch George's, Livermore, Julesburg, Sterling, Orchard, Wray, Greeley, Windsor, Estes Park, Boulder, Lafayette, Denver, Palmer Lake, Pinewood, Durango, Rockyford, Lamar and Holly.

regalis Dodge. A few specimens of this species were all taken by Mr. Ball. One specimen from Ft. Collins, August 14, and specimens from Holly, Lamar and LasAnimas bearing dates July 18 and September 8. Specimens determined by Prof. Bruner.

This is one of the handsomest of our Melanopli and is very different from the species of *Aeoloplus* that has been supposed to be Dodge's *regalis*.

This species might easily be mistaken for *sanguineous* Bruner.

sanguineus Bruun. (See description in article following this). A few specimens only and all from the south-eastern portion of the State. The localities are Holly, Lamar, Las Animas and Rockyford. Dates, July 17th to Sep. 14th (Ball). In general appearance closely resembling *regalis*.

simplex Scudd. Two males have been taken in the Arkansas Valley, one at Holly, Sep. 8, 1898, and one at Nepesta, Aug. 6, 1900 (Ball). The first measures 17 mm. and the second 19 mm. Tegmina of male from Holly 8 mm. and of the one from Nepesta 13 mm. The latter specimen has blue hind tibiae and may belong to *glaucipes*, but aside from the longer elytra and the different colors of the tibiae, and the difference in size, the two specimens appear to be identical. This species seems a very close relative of *glaucipes* but in general appearance, as we have them determined, *glaucipes* is more slender and with the male abdomen nearly straight, while in *simplex* the male abdomen is strongly upturned at the end.

spretus Uhl. I cannot help suspecting that some of the reported occurrences of this species have been from specimens of *atlantis*. During thirteen years of collecting in Colorado, and we have done a large amount of it, we have not taken a single specimen of this locust. I do not think it can have any permanent breeding ground within this State at present.

tristis Bruner. See description in article following this.

yarrowi Thom. A single pair were taken at Grand Junction Aug. 28, 1894. This species looks very much like *M. flavidus* with hind tibiae red, or like a light colored specimen of *M. femoratus* without the pale stripes and not so robust. Length of male 25 mm. and of female 35 mm.

PHCETALIOTES Scudder.

nebrascensis Thom. Another common species on grass land on the eastern plains of the State. Its food-plant, so far as our observations have gone, is blue-grass (*Agropyrum glaucum*). This species is rather late in maturing. On July 16, 1902 at Ft. Collins many nymphs but no adults were observed upon *Agropyrum*. On July 30th the adults were common. On Aug. 1st, 1901 at the same place it was noted that there were many nymphs and a few adults upon blue-grass. The adults

were still common Sep. 25th, 1898, near Ft. Collins (notes by Ball).

The males in the collection vary between 19 mm. and 23 mm. in length and the females measure from 23 mm. to 29 mm. in length. The elytra of the short-winged males vary between 5 mm. and 6.5 mm in length and those of the females between 5.5 mm. and 7.5 mm. in length.

A few specimens of the long-winged form (*volucris*) have been taken at Ft. Collins and one specimen was taken at Lamar.

We have taken the species at the following places: Ft. Collins, Greeley, Julesburg, Merino, Pueblo, Colorado Springs, Rockyford, Lamar and Holly.

DACTYLOTUM Charpentier.

pictum Thom. A fairly common species on the plains of the eastern portion of the State and occurring on dry exposed areas for some distance within the foothills but not far. Its principal food-plant, according to Prof. Ball's notes, seems to be *Aster multiflora* though he has several times noted it feeding upon *Kalmia glauca* (American laurel). He has also seen it resting upon *Senecio Douglasi*, apparently as a food-plant, and we have found occasional specimens on alfalfa.

The bright coloration is very constant; males vary between 20 mm. and 24 mm. in length and the females between 29 mm. and 35 mm. The wings of the males vary between 4 mm. and 5 mm. and those of the females between 5 mm. and 6 mm. Taken at the following places: Ft. Collins, Laporte, Livermore, Wray, Pueblo, Rockyford, Lamar and Holly.

We have found the species abundant just outside the first foothills and have taken adults at Ft. Collins from July 26th to Sep. 30th.

Some New Colorado Orthoptera

BY LAWRENCE BRUNER.

Nemobius brevicaudus new species.

A medium sized, pale colored insect in which the female has an exceedingly short ovipositor, not much more than one-half as long as that of other species in which this member is described as greatly abbreviated. In general appearance perhaps most closely resembling *N. mormonius* Scudd. from Utah.

Pale testaceous with a few darker markings on head, pronotum and abdomen above. The pronotum a little narrower in front than behind, its surface sparsely adorned with rather stiff, not very long, dark colored bristles. Front and middle femora, as well as the front between the base of antennæ, likewise adorned with similar bristles. Tegmina half as long as abdomen, about as long as head and pronotum combined (♀), or nearly reaching its apex (♂) pale testaceous, without any definite darker markings. Ovipositor very short, straight, the apical half moderately coarsely toothed above, the extreme apex rather blunt. Anal stylets pale, slender, a little longer than hind tibiæ. Antennæ rather long and slender, testaceous basally, darker beyond.

Length of body, ♂, 8 mm., ♀, 8.5 mm.; of hind femora, ♂, 5 mm., ♀, 5.5 mm., of ovipositor, 1.85 mm.

Habitat. 1 ♂, 1 ♀, Fort Collins, Colorado, October 4, 1901.

Ceuthophiuis aridus new species.

Of a uniformly pale testaceous color, a trifle darker above than below, unadorned by darker mottlings, bands or blotches of any kind, a moderately slender insect with relatively smooth body and limbs. Eyes very dark brown or black, pyriform, the apex below. Front femora about one-fourth longer than pronotum, their front edge below provided with 1-2 very small spines in addition to a much longer preapical one, the lower posterior edge unarmed; anterior lower edge of middle pair armed with 3-4 and the posterior with 2-3 minute ones, the apex of the latter edge provided with an apical spine. Hind femora rather robust, without any decided genicular enlargements, a trifle over three times as long as greatest width, the apical half provided above with a number of dark raised points, and both the outer and inner lower carinæ furnished with numerous fine serrations, the sulcus rather narrow except near the apex. Hind tibiæ about one-sixth longer than femora, nearly straight and provided with four pairs of moderately strong gently diverging spines

in addition to the apical ones which are somewhat longer than the others; hind tarsi about one-third the length of the hind tibiæ, joint 2 twice as long as 3. Cerci rather slender, in length less than the greatest width of hind femora and abruptly bent downwards at about the middle.

Length of body, ♂, 12.25 mm., of pronotum, 3.45 mm., of fore femora, 4.2 mm., of hind femora, 9.65 mm., of hind tibiæ, 10.5 mm.

Habitat. A single ♀, November 17, at Grand Junction, Colorado.

On account of its uniform pale color this insect reminds one at first glance of all three of the following named species; viz., *C. alpinus* Scudd., *C. pallescens* Bruner, and *C. vinculatus* Scudd., from all of which, however, it differs in several important points as indicated in the description.

Ageneotettix occidentalis new species.

Very similar to both *A. scudderi* and *A. deorum*, but differing from both of these in its somewhat slenderer form and smaller size, as well as in the fewer (9) spines on the outer row of hind tibiæ, and in its normally somewhat abbreviated tegmina and wings.

Length of body, ♂, 10.5-13 mm., ♀, 15-18 mm.; of pronotum, ♂ 1.95-2.10 mm., ♀, 2-2.15 mm.; of tegmina, ♂, 7-9 mm., ♀, 9-10 mm.; of hind femora, ♂, 7.25-9 mm., ♀, 8.5-10 mm.

Habitat. Various localities in Colorado west of the main range, during the months of July, August and September (Collection Colorado Agricultural College).

Whether or not these are distinct, or only well marked geographical forms of a single rather variable species, is not certain now. However, the following brief synoptical table will show the main differences among these forms:

- A¹. Normally with somewhat abbreviated tegmina and wings in both sexes. Hind tibiæ nine spined in outer row. *occidentalis* n. sp.
 A². Normally with tegmina and wings hardly ever shorter than abdomen. Hind tibiæ ten or eleven-spined in outer row.
 B¹. Smaller, the tegmina and wings about equalling the abdomen in length even in ♂. Fastigium slightly acute-angled in male. *deorum* Scudd.
 B². Larger, the tegmina and wings slightly surpassing tip of the abdomen in ♂. Fastigium right angled or even more obtuse in male as well as in female. *scudderi* Bruner.

Encoptolophus coloradensis new species.

Somewhat resembling *E. sordidus* in general form but differing from it in a number of respects. The chief of these variations are a lower median carina of the pronotum in which the two sections are about equal in height, glaucous instead of fuliginous hind tibiæ, and a prevailing pale grayish testaceous color with decided dark markings on tegmina, hind femora and posterior half of pronotal disc.

Head unusually large and gross, quite distinctly broader than the front edge of the pronotum and higher than the general depth of the body; the vertex between the eyes about as wide as the shortest diameter of the latter, the scutellum broadly pyriform, rather shallow and provided in its posterior half with a well defined longitudinal carina which is continuous over the occiput to the front edge of the pronotum; lateral foveolæ small, triangular, scarcely sulcate; frontal costa rather prominent, the sides evenly diverging downwards, quite deeply sulcate in the vicinity of the ocellus, the bounding walls heavy; antennæ about reach-

ing the hind edge of the pronotum. Pronotum somewhat stragulate in advance of the principal sulcus, the lateral carinæ not much interrupted though bowed, fairly prominent; the median carina straight, of medium height, cut a little in advance of its middle; hind edge of the disk somewhat obtuse-angled. Tegmina and wings about equalling the abdomen in length, the apex of former broadly rounded. Hind femora normal, not quite reaching the tip of the abdomen.

General color pale grayish testaceous, the sides of pronotum obscurely banded with dull black or brown, the disk of pronotum with the X-shaped pale marking of *sordidus*, *costalis* and *parvus*. Tegmina crossed with four heavy dark bands and marked basally with irregular small blotches. Hind femora decidedly trifasciate with fuscous externally; hind tibiæ largely glaucous, the base pale. Sutures of abdomen narrowly black.

Length of body, ♂, 19 mm., ♀, 28 mm.; of antennæ, ♂, 7 mm., ♀, 8 mm.; of pronotum, ♂, 4 mm., ♀, 5 mm.; of tegmina, ♂, 17, ♀, 20; of hind femora, ♂, 11 mm., ♀, 14 mm.

Habitat. Fort Collins, Colorado, August 14, a single ♀ (C. P. Gillette); same locality, 1 ♂, and 1 ♀ (L. Bruner).

***Trimerotropis inconspicua* new species.**

A trifle under the medium size for the *vinculata* group to which it belongs, and at once recognized by its generally light color and comparatively narrow, but well defined, posteriorly converging tegmina bars, together with the pale disk of pronotum.

Head of moderate size, the eyes a trifle prominent and semiglobose. Vertex longer than wide and provided with a well-defined longitudinal carina. Antennæ dark brown annulated with testaceous, nearly or quite as long as hind femora. Pronotum rather flat on disk but provided with a network of low, smooth ridges which gives its surface a granular appearance; the anterior lobes very little tumid and furnished with a median carina which is but little more prominent than that on the hind lobe; posterior edge of disk right-angled in both sexes. Tegmina extending nearly one-third (♂) or only about one-fifth (♀) of their length beyond the tip of abdomen, the veinlets on basal half or two-thirds very numerous and a trifle coarse, thereby giving to that portion of these members a sort of granular appearance. Hind femora moderately slender, not quite reaching (♀) or a little surpassing (♂) the tip of abdomen.

General color very light cinero-ferruginous, with the usual dark-brown or blackish markings of the group to which it belongs. In some specimens the anterior portion of pronotum both on sides and disk are marked with clusters of small black flecks, but in others this portion is entirely pale—being relieved only by the brownish dots which adorn the carinæ of vertex, front, cheeks, pronotum, etc. The pale ferruginous tint which pervades the whole insect is due chiefly to the color of the bottom of punctuations which are well scattered over its surface. While the bands on tegmina are not solid they are quite prominent and made up of clusters of dark dots or by the infuscation of certain veinlets. On the basal portion these bands are narrower than usual and show a decided tendency towards converging posteriorly, while the apical portion is nearly destitute of markings save for the infuscation here and there of a few veinlets. Wings with their disks very pale greenish-yellow, crossed about the middle by a narrow fuliginous band which sends its anterior spur nearly one-half way to the base, the apical portion beyond the band perfectly transparent. Hind femora with lower sulcus yellow or at least with two pale bands. Hind tibiæ, except on extreme base where they are dark-brown, pale greenish-yellow, a little infuscated beyond the subbasal pale annulus and apically. Front and middle legs with well marked dusky annulations.

Length of body, ♂, 17 mm., ♀, 24-26 mm.; of antennæ, ♂, 10 mm., ♀, 10.5 mm.; of pronotum, ♂, 4 mm., ♀, 5.5 mm.; of tegmina, ♂, 18.5 mm., ♀, 24-25 mm.; of hind femora, ♂, 10-10.5 mm., ♀, 10.5-12 mm.

Habitat. Paonia, Palisades, Rifle and Dolores, Colorado, during the months of July and August.

In the McNeill table of species of *Trimerotropis* this insect will fall into the *vinculata* group with *salina*, *similis pallidipennis* and *longicornis* (The latter a new species described by E. M. Walker in *Can. Ent.* xxxiv, 4). That portion of the table may therefore be modified as follows:

- f*¹. Lower sulcus of posterior femora light, with one preapical black band, or black, with two light bands, one preapical and one median, the latter not merely interrupting the black on the edges of the sulcus, but in the bottom as well.
- g*¹. Fuscous band in its usual position in the middle of the wing. Spur extending less than half way to the base.
- h*¹. General color light cinereo-ferruginous. The bands of tegmina well marked and rather strongly converging towards the posterior edge..... *inconspicua* n. sp.
- h*². General color dark fuscous brown, permitting little contrast in the bands of tegmina, the latter not markedly converging towards posterior edge.
- i*¹. Metazona scarcely more than one and one-half times as long as prozona. Fuscous band variable.
- j*¹. Fuscous bands of wings very broad, occupying nearly one third the length of the wings, apical portion with only a few fuscous dots..... *salina* McNeill.
- j*². Fuscous bands of wings narrower, occupying less than a fifth of the length of the wings, apical portion rather strongly infuscated..... *longicornis* Walk.
- i*². Metazona twice as long as the prozona. Fuscous band rather narrow, occupying no more than a sixth or seventh of the length of the wings..... *similis* Scudd.
- g*². Fuscous band entirely beyond the middle of the wing, making the length of the disk equal to the width. Fuscous spur extending more than half way to the base..... *pallidipennis* Burm.
- f*². Lower sulcus of the posterior femora black, with but one preapical light band..... *vinculata*, *huroniana*, *collaris*, *fratercula*, *saxatilis*, and *sordida*.

***Aeoloplus minor* new species.**

A small, slender, short-winged insect with pinkish or light purplish hind tibiae, in which the supraanal plate of male resembles quite closely that of the longer-winged *Ae. tenuipennis* Scudder, from Arizona.

Head a little longer than the front edge of pronotum, the occiput somewhat ascending; eyes only moderately prominent, the vertex between them a little narrower than the frontal costa between the antennae and deeply sulcate to upper end of costa, in both sexes; the latter scarcely sulcate even at the ocellus; antennae short and slender, scarcely reaching hind edge of pronotum in either sex. Pronotum with the anterior lobes about equal, the disk smooth and evenly rounded, without a perceptible median carina; hind lobe slightly expanding posteriorly, the surface punctulate and with a slight median carina, the hind edge broadly angulate. Tegmina and wings abbreviated, rather narrow and evenly tapering, reaching from the middle to three-fourths the length of abdomen. Hind femora robust and furnished at base with a large downward projecting tooth, reaching beyond the tip of abdomen in both sexes. Apical segments of male abdomen only slightly enlarged, the last ventral segment ending in a short, blunt, upward projecting point; cerci nearly as long as supraanal plate, evenly tapering on basal three-fourths, equal beyond, the apical portion gently bent inwards; supraanal plate subtriangular, the sides sinuose and having the apex produced and

rounded, the surface practically as described for *Ae. tenuipennis*. Valves of ovipositor slender, short.

General color testaceous, varied with the usual brown markings, in some specimens with an olivaceous tinge, especially on tegmina and hind femora. Sides of basal abdominal segments and about base of supraanal plate and cerci dark brown or piceous. Posterior femora with the usual dusky bands which are some shade of olive or brownish olive, the genicular lobes and base of tibiae a little darker, the latter decidedly pinkish or pale lilac, in some specimens changing to glaucous apically.

Length of body, ♂, 12 to 14 mm., ♀, 14 to 15 mm.; of pronotum, ♂, 3.1 mm., ♀, 3.85 mm.; of antennæ, ♂, 6 mm., ♀, 5 mm.; of tegmina, ♂, 6-7.5 mm., ♀, 6.5-7.5 mm.; of hind femora, ♂, 6 mm., ♀, 8 mm.

Habitat. ♂s and ♀s, Delta, Colorado, July 13, 1901.

The annexed portion of Scudder's table will show the affinities of the present species:

d². Cerci of male tapering almost uniformly through the basal three-fourths, only the apical half or less equal.

e¹. Larger. The tegmina and wings almost as long as abdomen.

Hind tibiae pale glaucous *plagiosus* Scudd.

e². Smaller. Tegmina and wings from one-half to three-fourths as long as abdomen. Hind tibiae pinkish or pale purplish.

minor n. sp.

***Hesperotettix Gillettei* new species.**

The distinguishing characters of the present species are the non-observed transverse sulci of pronotum, the very narrow tegmina and bright salmon-colored anterior and middle, as well as the entire upper edge and pregenicular annulations of hind femora.

A bright grass-green locust with prominent white lines on thorax and along humeral angles of tegmina. In comparison with *Hesp. viridis* it is a somewhat slenderer insect of a more subdued and uniform color in which the pronotum is less expanded posteriorly and the tegmina and wings are decidedly narrower and show a variation in length from about one-half as long to a trifle exceeding that of the abdomen, a little longest in the males. It differs from its nearest ally, *Hesp. festivus*, in being of a much more uniformly cylindrical form and greenish color, in its more cylindrical pronotum and the heavier hind femora, the shorter and heavier cerci and the slightly more elevated and blunter apex of subanal plate of male abdomen.

Length of abdomen, ♂, 15 mm., ♀, 21 mm.; of pronotum, ♂, 3.5 mm., ♀, 5 mm.; of antennæ, ♂, 7.5 mm., ♀, 6.5 mm.; of tegmina, ♂, 6 to 11.5 mm., ♀, 7.5 to 16 mm.; of hind femora, ♂, 9 mm., ♀, 12 mm.

Habitat. Rifle, Colorado, July 25, ♂s and ♀s; Glenwood Springs, September 15; Delta, July 13 and Grand Junction, July 29, September 16.

***Hesperotettix coloradensis* new species.**

A short-winged moderately robust insect which is quite closely related to *H. curtipennis*, but differing from it by its somewhat slenderer form, slenderer and shorter hind femora, the much shallower and less prominent transverse sulci of pronotum, the slenderer and longer valves of the ovipositor, and in lacking the pale border above dusky band on sides of pronotum. Otherwise the two forms are quite similar in general appearance.

Head small, eyes rather prominent; the vertex narrow, about as wide as basal (♀) or as second (♂) joint of antennæ, rather deeply sulcate in male, less so in female; frontal costa moderately broad, the sides nearly parallel, profoundly sulcate throughout. Antennæ with the joints somewhat depressed and heavier than usual in the male, in female nor-

mal. Pronotum subcylindrical, only gently widening behind, the anterior lobes smooth, only weakly punctate, and with ill-defined median carina; the hind lobe coarsely and rather closely punctate, its median carina quite evident, hind margin angulate. Tegmina lobate, lateral, their dorsal edges not touching. Hind femora slender, not quite reaching (♀) or gently surpassing (♂) the tip of abdomen. Apical portion of male abdomen slightly broadened, the extreme tip of last ventral segment gently raised above the level of apex; supraanal plate elongate, its sides upturned, the apex rounded and provided in middle with two rather coarse, blunt carinae which begin near the base just in advance of the furculæ which are mere protuberances and meet a little before tip; cerci moderately long, about reaching the tip of supraanal plate, their apex attenuate and gently curved inward; valves of ovipositor slender, somewhat exerted.

General color grass-green varied with pale testaceous and dirty white. The sides of pronotum back of eyes streaked longitudinally; with piceous bordered below by dirty white. Dorsum of thorax and abdomen with the usual light colored streak which frequently widens in the middle of anterior lobe of pronotum so as to form a sort of a diamond-shaped patch—a little interrupted just before reaching the hind edge. Hind femora internally and below testaceous, with scarcely any indication of the pregenicular ruddy annulation or tinge along upper edge.

Length of body, ♂, 16.5 mm., ♀, 24 mm.; of pronotum, ♂, 4 mm., ♀, 4.85 mm.; of antennæ, ♂ and ♀, 7 mm.; of hind femora, ♂, 9.5 mm., ♀, 10.5 mm.

Habitat. 1 ♂, Durango, Colorado, Aug. 7; 1 ♀, Dolores, Colo., Aug. 2. (Collection Colo. Agr. College).

With the addition of these two, and a third species from Florida, to those known to Scudder, we have his table of species considerably modified. This modified table is as follows:

ANALYTICAL KEY TO THE SPECIES OF HESPEROTETTIX.

- A¹. Metazona of pronotum distinctly punctate on dorsum; prozona smooth, except sometimes feebly punctate on dorsum; nowhere rugulose.
- b¹. Pronotum highly and irregularly diversified in color, or else nearly devoid of markings of any kind, the dorsum nearly plane; tegmina in the diversified species marked with a white or pallid stripe on the division line between the discoidal and anal areas.
- c¹. Transverse sulci of pronotum distinctly marked in black; hind femora with a distinct pregenicular annulation.
- d¹. Relatively slender-bodied, with slender femora; tegmina rarely as short as the body and then only in male; antennæ of male slender, distinctly longer than the head and pronotum together..... *viridis* Thom.
- d². Relatively stout-bodied, with stout femora; tegmina surpassing the body only in the males and then but slightly; antennæ of male coarse, scarcely longer than the head of pronotum together..... *meridionalis* Scudd.
- e¹. Transverse sulci of pronotum not marked in strong colored contrast to surroundings.
- d¹. Tegmina not abbreviate, about as long as the abdomen. Hind femora without red pregenicular annulation or only faint signs of one..... *festivus* Scudd.
- d². Tegmina one-half or even a trifle longer than abdomen. Hind femora with a decided pregenicular annulation..... *gillettei* n. sp.

- b². Pronotum diversified in color only by longitudinal stripes, the dorsum distinctly tectiform; tegmina without pale stripes (though they are occasionally indicated).
- c¹. Tegmina lobiform, little or no longer than the pronotum, their upper edges not attinent.
- d¹. General color dark brown, occasionally with a tinge of green; tegmina short ovate, distinctly shorter than the pronotum.....*pacificus* Scudd.
- d². General color grass-green; tegmina long oval, scarcely shorter than the pronotum.
- e¹. Slender. Pronotum decidedly angulate behind, very preceptibly widening posteriorly.
coloradensis n. sp.
- e². More robust. Pronotum with hind margin broadly rounded, of nearly equal width throughout.
curtipennis Scudd.
- c². Tegmina fully developed or abbreviate, when the latter nearly or fully twice as long as pronotum, their upper edges overlapping.
- d¹. Tegmina and wings abbreviate, much shorter than the body.....*brevipennis* Thom.
- d². Tegmina and wings distinctly surpassing the abdomen, or sometimes in the female only equalling it.
pratensis Scudd.
- A². Pronotum decidedly tectiform; both prozona and metazona, both on dorsum and lateral lobes, equally and distinctly rugulose.
- b¹. Tegmina elongate, two to five times as long as broad, roundly acuminate at tip.....*speciosus* Scudd.
- b². Tegmina ovate, at most one and one-half times as long as wide.....*floridensis* Morse.

***Melanoplus sanguineus* new species.**

Rather above the medium in size, a moderately robust insect having the general color aspect of *M. atlanis* and its allies, but differing from these species by its more robust hind femora which are rich blood-red inside and below, and in having the hind tibiæ very decidedly bluish-green as in *M. occidentalis* and some other species like *M. glaucipes* Scudder and *M. regalis* Dodge.

Head a little wider than the front edge of pronotum; occiput somewhat elevated above the plane of its disk, eyes fairly large but not very prominent even in the males; vertex a very little wider (♂), or about twice as wide (♀) as diameter of basal antennal joint; the fastigium roundly depressed and rather broadly and deeply sulcate; frontal costa about as wide above as vertex, broadening a trifle below and reaching the clypeus, punctuate above, gently sulcate at ocellus and below; antennæ a trifle longer than head and pronotum together. Pronotum with the sides of anterior lobes about parallel, hind lobe considerably expanding towards the rear, transverse sulci profound, the last about the middle; median carina faint on anterior lobes but prominent on posterior, the latter with its hind edge angulate. Anterior portion of male mesosternum provided with a large blunt protuberance. Tegmina rather narrow, tapering but little apically, reaching beyond the tips of hind femora in both sexes. Anterior and middle femora not greatly enlarged in male, the hind pair moderately robust, a little surpassing the abdomen in both sexes. Extremity of male abdomen neither clavate nor recurved, the subgenital plate short, the apex but little produced and not notched. Supraanal plate broadly triangular, the sides rounded and the apex a little produced, the middle furnished with a rather deep narrow groove which runs from the base nearly to the apex, a little wider and shallower near its termination, the sides undulate near base and projecting over the cerci. The latter nearly equal throughout, a little more than twice as long as greatest width, the apical half bent inwards and with their outer face slightly indented, the lower corner of apex obliquely docked.

Furcula consisting of a pair of moderately depressed, slender, parallel fingers equal and attingent on basal half, tapering for a short distance and slender and equal in outer third, slightly less than half as long as the supraanal plate.

General color varying from a pale testaceous to a dull wood brown, in the lighter individuals tinged above with ferruginous. Sides of head back of the eyes, and pronotum to last transverse incision provided with a well defined piceous band, in some specimens a trifle interrupted by light patches. Occiput usually provided with a similar dark band that begins at the vertex and extends backward to front edge of pronotum. Disk of latter usually pale, but sometimes becoming a little infuscated in middle. Tegmina provided with a discal row of fuscous dots in a pale field, beyond the basal half these also occupy the remainder of the wing. Hind femora provided above and on upper half of outer face with three dusky bands, the apex black preceded by a pale annulus, inner face and lower outer edge, together with lower sulcus, bright blood red; hind tibiae bluish-green, the knees and genicular lobes of femora bluish-white.

Length of body, ♂, 22.5 mm., ♀, 25 mm.; of antennae, ♂, 9.5 mm., ♀, 10 mm.; of pronotum, ♂, 5.1 mm., ♀, 5.5 mm.; tegmina, ♂, 20 mm., ♀, 21 mm.; of hind femora ♂, 13 mm., ♀, 14 mm.

Habitat. ♂s and ♀s Lamar and Las Animas, Colorado.

This insect would fall in Scudder's table for the separation of our species of *Melanoplus* near *bruneri*, *excelsus* and *utahensis*. The table would have to be modified for its reception as follows. (Bottom page 131):

*g*². Apical margin of subgenital plate of male conspicuously elevated above the lateral margins and sometimes greatly prolonged posteriorly; mesosternum of male in front of lobes with a central swelling, forming a blunt tubercle (5. *Utahensis* series).

*h*¹. Apical margin of subgenital plate of male entire; lobes of furcula not exceptionally broad.

*i*¹. Subgenital plate only moderately prolonged.

sanguineus n. sp.

*i*². Subgenital plate greatly but not excessively prolonged.

*j*¹. Interval between mesosternal lobes of male more than twice as long as broad, of female a little longer than broad; male cerci more than twice as long as broad; apical margin of subgenital plate of male, as seen from behind, subtruncate *bruneri* Scudd.

*j*². Interval between mesosternal lobes of male much less than twice as long as broad; of female transverse; male cerci less than twice as long as broad; apical margin of subgenital plate of male, as seen from behind, rounded.

excelsus Scudd.

*h*². Apical margin of subgenital plate of male deeply notched on either side of middle; lobes of furcula exceptionally broad, subequal throughout; subgenital plate excessively prolonged.

utahensis Scudd.

***Melanoplus tristis* new species.**

A rather small, slender, short-winged insect that bears a strong resemblance to *M. artemisiæ* but which more properly belongs to the *Aridus* series since it has the cerci and furcula of the male as found in the last named species. Entire insect quite strongly hirsute or pilose.

General color dark reddish brown, varied with darker brown and piceous. Head about as wide (♀) or a little wider (♂) than the front edge of the pronotum, the occiput a little raised above the plane of the latter; eyes large and quite prominent, sub-globular in the male, considerably less prominent and with the anterior edge decidedly straight in

female; vertex a trifle narrower (♂) or somewhat wider (♀) than the basal antennal joint, roundly depressed and quite deeply sulcate with the lateral carinae rather coarse; frontal costa prominent, plain, the sides nearly parallel, a little wider than the vertex between the eyes in both sexes and reaching the clypeus. Antennae slender, of moderate length, about reaching, ♀, or somewhat surpassing, ♂, the tip of pronotum. The latter with the sides of anterior lobes somewhat tumescent in ♂, smooth in ♀, no wider at last transverse incision than in front, the dusky band at sides furnished near the center above with a light patch, the posterior lobe a little the shorter, expanding and broadly rounded behind, its entire surface quite profusely punctate; median carina nearly equally prominent throughout. Prosternal spine coarse, conical, moderately long, directed a little to the rear and with the apex blunt. Tegmina lateral, elongate oval, reaching to or a little beyond the apex of the first abdominal segment. Abdomen with the sides strongly piceous, especially in the ♂s. Hind femora rather slender, not quite reaching (♀) or a little surpassing (♂) tip of abdomen, flavous inside and below, crossed on upper half by two dusky bands, the apex also dark; middle and front femora only moderately swollen or obese in males; hind tibiae dull plumbeous, profusely hirsute. Apical portion of male abdomen only gently club-shaped, the tip very little upturned, the subanal plate entire at apex, in no wise notched or produced; supraanal plate triangular, about equally long and broad, the sides straight, the tip angulate; the furcula as described and figured for *M. aridus* Scudd. (Pl. xiv, fig. 3); cerci also as in that species, except, perhaps, that they may be slightly longer in proportion and a little more bent inwards on their outer half.

Length of body, ♂, 13.5 mm., ♀, 18-20 mm.; of antennae, ♂, 7 mm., ♀, 6.5 mm.; of pronotum, ♂, 3.1 mm., ♀, 4 mm.; of tegmina, ♂, 2.6 mm., ♀, 3 mm.; of hind femora, ♂, 8 mm., ♀, 9 mm.;

Habitat. Antonita, Dolores and Durango, Colo., 3 ♂s and 5 ♀s August (Collection Colo. Agr. College).

In order that the position of this species may be more clearly indicated the following portion of Scudder's table is modified so as to include it and is here appended:

*g*¹. Cerci of male long and very slender, in the middle not one-half the width of the frontal costa, last dorsal segment of male with a pair of strongly oblique submedian sulci outside the furcula; subgenital plate not elevated apically (3. *Aridus* series).

*h*¹. Hind margin of pronotum truncato-emarginate; disk of metazona fully twice as broad as long; tegmina relatively slender, widely distant.

*i*¹. Disk of pronotum coarsely and uniformly punctate; cerci of male apically enlarged and inferiorly acuminate at apex.

humphreysii Thom.

*i*². Disk of prozona coarsely punctate only along anterior margin; cerci of male apically equal, round at tip.

nitidus Scudd.

*h*². Hind margin of pronotum obtuse angulate or broadly rounded; disk of metazona less than twice as broad as long; tegmina variable.

*i*¹. Larger (♂ 17.5 mm.); tegmina relatively broad, approximate, at least in the male..... *aridus* Scudd.

*i*². Smaller (13.5 mm.); tegmina quite slender, lateral, and greatly separated above in both sexes..... *tristis* n. sp.

Melanoplus flabellifer brevipennis new variety.

The specimens before me, eight in number, and coming from Pao-
nia and Palisades in western Colorado agree quite well with the general

description of *M. flabellifer*, only that all of them lack the fully developed tegmina and wings of that insect. The specimens from Palisades are decidedly tinged with rufous, while those collected at Paonia are cineroplumbeous as indicated for the normally long-winged form.

Length of body, ♂, 14-16 mm., ♀, 21 mm.; of antennæ, ♂, 7.5 mm., ♀, 7 mm.; of tegmina, ♂, 5.5 mm., ♀, 7 mm.; of hind femora, ♂, 8.5-9 mm., ♀, 10-11 mm.

Habitat. 4 ♂s and 1 ♀, Palisades, Colorado, July 8, 1901; 2 ♂s and 1 ♀, Paonia, Colorado, September 20, 1903, (Collection Colorado Agricultural College).

The following synoptic table which has been somewhat modified from Scudder's (Revis. Melanopli, pp. 124 and 130, and Suppl. p. 160) will give at a glance the characters separating the various recognized forms belonging to the series:

- d¹. Cerci of male very broad and short, not more than twice as long as the middle breadth, and broadly rounded at apex. (2. Flabellifer series.)
- e¹. Tegmina fully developed.
- f¹. Cerci of male twice as broad in broadest as in narrowest portion.
- g¹. Subgenital plate of male with a distinct though minute independent apical tubercle.....*occidentalis* Thom.
- g². Subgenital plate of male with only one obscure trace of apical tubercle.....*cuneatus* Scudd.
- f². Cerci of male with no striking inequality in breadth.
flabellifer Scudd.
- e². Tegmina more or less abbreviated.
- f¹. Tegmina about half as long as the abdomen and much longer than the pronotum.
- g¹. Cerci of male broadly longitudinally sulcate apically, as in *flabellifer*.....*flabellifer brevipennis* n. var.
- g². Cerci of male not longitudinally sulcate apically.
- h¹. Interval between mesosternal lobes of male twice as broad posteriorly as anteriorly, the inner margins of the lobes regularly divergent; interval in female longer than broad; cerci of male but little longer than broad.....*discolor* Scudd.
- h². Interval between mesosternal lobes of male nearly equal breadth in front and behind, the inner margins of the lobes convex; interval in female transverse; cerci of male nearly twice as long as broad.
simplex Scudd.
- f². Tegmina shorter than pronotum.
- g¹. Furcula of male only as long as the last dorsal segment; cerci in apical half equal and deeply sulcate longitudinally, so as to appear bent at right angles.
rileyanus Scudd.
- g². Furcula one-fifth as long as supraanal plate; cerci in apical half tapering, not sulcate.....*blandus* Scudd.
- Melanoptus dimidipennis** new species.

A brachypterous insect the size of which is slightly below the medium and in which the tegmina and wings reach a trifle beyond the middle of the abdomen. Legs, under parts, and abdomen very light colored, the latter almost white except the two basal segments which for the most part are black on sides and above. Pleuræ and upper half of sides of front lobe of pronotum also very strongly marked with fuscous, their ground color along with greater portion of head light plumbeous. Hind tibiæ dirty yellowish-white with a greenish tinge.

Entire insect sparsely clothed with rather long erect light-colored hairs. Head a little wider than front edge of pronotum, the eyes only moderately prominent, a trifle longer than the cheeks below them; vertex rather broad, nearly twice the diameter of basal joint of antennæ, the fastigium shallowly but broadly sulcate, depressed and roundly uniting with upper extremity of the broad prominent frontal costa, the latter with straight edges and expanding but little below where it reaches the clypeus, broadly sulcate at ocellus and below and with a few scattered punctures above. Antennæ a little longer than combined length of head and pronotum. Pronotum with the anterior lobes a very little longer than the hind lobe, smooth and shining, the sides parallel; hind lobe diverging posteriorly, the surface profusely punctate, the hind margins of disk broadly angulate; median carina quite conspicuous on posterior lobe, almost obliterated on anterior lobes; transverse sulcus rather prominent, especially the posterior one which is profound and nearly straight. Prosternal spine rather long, fairly stout, regularly pyramidal, straight and with the apex rounded. Space between mesosternal lobes about half again as long as broad, divergent behind. Anterior and middle femora not especially heavy; the hind pair somewhat robust. Apical portion of ♂ abdomen very little or not at all enlarged; subgenital plate longer than wide, directed backward and gently upward, the extreme apex a little produced, entire but with the surface just before it depressed so as to give it the appearance of being notched as in *atlanis* and allies; supraanal plate broadly triangular, the sides sinuate and with the edges on basal half raised, the middle provided with two rather prominent nearly parallel carinæ inclosing a profound longitudinal channel which reaches from the base nearly to the apex, but which is interrupted a little beyond the middle by a low cross ridge joining the bounding walls. Marginal apophyses a little longer than width of preceeding segment, evenly tapering to a point, their bases touching, directed backwards and outwards so that their tips cross beyond the outer edge of the walls of central fovea of plate. Cerci about twice as long as broad, of nearly equal width, their lower outer edge gently truncate and the apex rounded, directed backward and inward.

Length of body, ♂, 18 mm.; of pronotum, 3.4 mm.; of antennæ, 7 mm.; of tegmina, 8 mm.; of hind femora, 10.25 mm.

Habitat. Fort Collins, Colorado, a single ♂ on August 16th.

By the use of Scudder's table for separating the species of *Melanoplus* as published in his "Revision of the *Melanopli*" this insect seems to come near *M. dawsoni*. In the characters of the tip of male abdomen it reminds one a little of *M. intermedius*, but other characteristics throw it out of the *atlanis* group.

The Bees of the Genus *Nomada* Found in Colorado,

With a Table to Separate All the Species
of the Rocky Mountains.

BY T. D. A. COCKERELL.

When I undertook to work up the species of *Nomada* contained in the collection of the Colorado Agricultural College, I supposed that I should find a few new ones, but that the great majority would be well-known forms long ago discovered by Morrison, Ridings, and others. I find that the collection contains 29 species and varieties, and of these no less than 15 are new. Two others represent undescribed sexes of species previously known. This result serves to indicate the richness of the Agricultural College collection in rare and new forms, and the great value of the material gathered together by Professor Gillette and his associates. I have included in the table of species all those known to occur in Montana, Wyoming, Colorado and New Mexico. Some synonyms and doubtful records have been omitted. Our knowledge of the more northern species, from Wyoming and Montana, is exceedingly incomplete, but it is perhaps not without significance that the few species known from these states all range eastward. The species of Colorado, on the other hand, appear to represent a largely endemic fauna, though some eastern elements appear, particularly in the north. It is possible to separate the species into three groups, those which belong to the Rocky Mountain fauna proper,

those which are modified representatives of eastern species, and have probably reached Colorado in comparatively recent times, and those which are identical with species found east of the plains. Examples are as follows:

(1.) Rocky Mountain Fauna.—*N. rubrella*, *schwarzi*, *martinella*, *scita*, *grandis*, *civilis*, etc.

(2.) Modified eastern types.—*N. lepida*, *dacotana*, *wegana*, *zebrata*, *luteopicta*.

(3.) Typical eastern species.—*N. bella*, *albofasciata*, *cuneata* *superba*, *vincta*.

A few appear to be modifications of northwestern types; such are *taraxacella*, *pecosensis*, and possibly a few others. How far the species extend westward through Utah, etc., cannot be stated, owing to our almost complete ignorance of the *Nomadæ* of that region; but the California *Nomada*-fauna is very distinct from that of Colorado, and the comparatively few species seen from Nevada indicate the extension of the Californian fauna, at least in part, into that state. The same indications exist for Idaho.

The *Nomadæ* of the mountains of northern New Mexico naturally resemble those of Colorado to a considerable extent, but our present lists show a rather surprising amount of difference, perhaps mainly the result of inadequate collecting. The species of southern New Mexico are different, and belong to a southwestern fauna which no doubt extends into Arizona and northern Mexico, though no knowledge of the *Nomadæ* of those regions exists, excepting a single record from Juarez in Chihuahua.

It is hoped that the present paper will facilitate the study of *Nomada* in Colorado. The genus offers a very excellent field for research, and I venture to hope that some advanced student of the Agricultural College will interest himself in it. Undoubtedly more new species await discovery, while the habits of none of the species have been investigated. Very many species are known only in one sex, and there are probably some cases in which the opposite sexes of the same species have been described as distinct.

As is well known, *Nomada* is parasitic in the nests of other bees, principally *Andrena* and *Halictus*. This parasitism should be carefully studied, and it is necessary to breed the bees from the nests in order to fully establish it. It is difficult for me to believe that the same species of *Nomada* can be parasitic in nests of both *Andrena* and *Eucera*, as has been reported of *N. alternata* and *N. agrestis*; or in nests of both *Halictus* and *Colletes* as is recorded of *N. furva*.

TABLE FOR THE DETERMINATION OF THE SPECIES.

Vertex and mesothorax smooth and shining; male entirely black, females with a red abdomen (Montana).....	<i>grindeliae</i> Ckll.
Not so, never entirely black.....	1.

1. Normally with only two submarginal cells; abdomen red with yellow bands, first segment red without a band (Montana)..... *obliterata* Cress.
Normally with three submarginal cells..... 2
2. Very large and robust, over 13 mm. long, red with abundant yellow markings 3.
Smaller, usually much smaller 4.
3. Basal nervure considerably basad of transverse medial (Colo.)..... *grandis* Cress.
Basal nervure meeting transverse medial (Colo.)..... *magnifica* Ckll.
4. Mandibles bidentate 5.
Mandibles simple..... 14.
5. Males 6.
Females..... 12.
6. Tegulae more or less yellow; scutellum usually with yellow spots; abdomen with yellow bands (Colo.)..... *lepida* Cress.
Tegulae red; scutellum black or red..... 7.
7. Thorax red marked with black..... 8.
Thorax black, with or without red spot on the scutellum..... 10.
8. Length about 7 mm.; light markings creamy white; metathorax red with a central black mark. (Colo.)..... *rubrella* Ckll.
Size larger; abdominal markings strongly yellow; metathorax entirely black..... 9.
9. Third antennal joint long; second submarginal cell broad above. (Colo.)..... *schwarzi* Ckll.
Third antennal joint shorter; second submarginal cell narrow above (N. M.)..... *schwarzi contractula* Ckll.
10. Size larger, length 9 to 10 mm., abdomen with yellow bands. (Colo.)..... *bella* Cress.
Size smaller 11.
11. Abdomen with white bands. (Colo.)..... *albofasciata* Smith.
Abdomen with yellow spots or bands. (Colo.)..... *cuneata* (Rob.)
12. Larger, 10 mm. long or over. (Colo.)..... *bella* Cress.
Smaller, 8 or 9 mm. long..... 13.
13. Red of abdomen dark. (Colo.)..... *cuneata* (Rob.)
Red of abdomen light. (Colo.)..... *lepida* Cress.
14. Anterior coxae strongly spined; abdomen strongly punctured..... 15.
Anterior coxae not or hardly spined; abdomen usually very minutely or not distinctly punctured..... 35.
15. Males 16.
Females 26.
16. Apex of abdomen entire; supraclypeal mark surrounded by black. (N. M.)..... *lippiae* Ckll.
Apex of abdomen notched, though sometimes feebly..... 17.
17. Flagellum with a light median area, on each side of which is black..... 18.
Flagellum ordinary, not so colored..... 21.
18. Tegulae pale yellow or whitish; supraclypeal mark present..... 19.
Tegulae deep ferruginous; ground-color of abdomen nearly all red. (Colo., Mont.)..... *americana dacotana* Ckll.
19. First abdominal segment largely red, without light markings. (N. M.)..... *sophiarum* Ckll.
First abdominal segment black or almost, with a narrowly interrupted cream-colored band..... 20
20. Abdomen comparatively narrow; legs clear light red. (Colo.)..... *scita* Cress.
Abdomen broad; legs darker. (Colo.)..... *martinella* Ckll.
21. Metathorax with yellow marks. (Colo., N. M.)..... *vegana* (Ckll.)
Metathorax without yellow marks..... 22
22. Mesothorax reddish, size rather large; wings dark. (Colo.)..... *lamarensis* Ckll.
Mesothorax entirely black, size smaller 23

23. Labrum entirely light red; light markings primrose-yellow; wings clear, strongly clouded at apex. (Colo.)..... **uhleri** Ckll.
 Labrum yellowish-white. (Colo.)..... **snowi** Cress.
 Labrum blackish, or with a large black spot..... 24
24. Light markings white; flies in spring. (N. M.)..... **vierecki** Ckll.
 Light markings yellow; fly in middle and late summer 25
25. Ventral surface of abdomen with two light bands. (N. M.)..... **crucis** Ckll.
 Ventral surface of abdomen dark with only minute light marks (N. M.)..... **neomexicana** Ckll.
26. Abdomen red, without light bands..... 27.
 Abdomen with light bands..... 28.
27. Flagellum clear red. (N. M., Colo.)..... **martinella** Ckll.
 Flagellum strongly dusky. (Colo., Mont.) **americana** **dacotana** Ckll.
28. Mesothorax reddish (here expect the unknown ♀ of **lamarensis** Ckll.)..... 29.
 Mesothorax black, with little if any red..... 29.
29. Abdomen red with white bands 30.
 Not so, ground-color of abdomen mainly or wholly black..... 31.
30. Mesothorax densely punctured. (Colo.)..... **ridingsii** Cress.
 Mesothorax with well-separated punctures on a shining ground. (N. M.)..... **vierecki** Ckll. var.
31. Lateral face-markings white or yellowish white. 32.
 Lateral face-markings yellow..... 33.
32. Mesothorax densely punctured (Colo.)..... **snowi** Cress.
 Mesothorax sparsely punctured on a shining ground (N. M.)..... **vierecki** Ckll.
33. Mesothorax with well separated punctures on a shining ground; ground color of first abdominal segment red (Colo.)..... **vegana nitescens** Ckll.
 Mesothorax densely punctured..... 34.
34. Metathorax with yellow spots (Colo., N. M.)..... **vegana** Ckll.
 Metathorax without yellow spots (N. M.) **neomexicana** Ckll.
35. Abdomen with numerous entire (or some slightly interrupted) light bands..... 36.
 Abdomen with light bands, more or less widely interrupted, at least on some of the segments..... 59.
 Abdomen red, with small yellow spots (sometimes bands on apical segments) or no light markings..... 66.
36. Abdominal bands white or yellowish-white; no light markings on head or thorax; venter of abdomen ferruginous, immaculate 37.
 Abdominal bands yellow..... 38.
37. Scutellum strongly bilobate; wings paler (Colo.)..... **parata** Cress.
 Scutellum not strongly bilobate; wings darker (Colo.)..... **munda** Cress.
38. Legs yellow and black, without very much red..... 39.
 Legs wholly or mainly red, or red and yellow 40.
39. Smaller; third antennal joint shorter than fourth on the under (light) side (Colo.)..... **civills** Cress.
 Larger; third antennal joint longer than fourth on the under side (N. M.)..... **pecosensis** (Ckll.)
40. First abdominal segment without yellow; ♂s..... 41.
 First abdominal segment with yellow..... 43.
41. First abdominal segment black; scutellum black (N. M.)..... **ruidosensis** Ckll.
 First abdominal segment red and black 42.
42. Size larger, scutellum red (Colo.)..... **coloradensis** Ckll.
 Size small, scutellum black with small light spots (Colo.)..... **coloradella** Ckll.
43. First abdominal segment black and red, with a yellow spot on each extreme lateral margin; flagellum stout, third antennal joint shorter than fourth; basal nervure basad of transverse-medial. 44.
 First abdominal segment with a yellow band, entire or interrupted 45.

44. Flies in June; a good deal of yellow on head and thorax (Colo.)..... **crawfordi** Ckll.
Flies in May; no yellow on head and thorax (Colo.)... **collinsiana** Ckll.
45. Metathorax ferruginous and black, without any yellow; ♂s.....46.
Metathorax entirely black.....47.
Metathorax black with rather small light spots; lateral face-
marks broad, but not or hardly going above level of an-
tennæ; apical plate of abdomen more or less notched; ♂s51.
Metathorax with two large yellow (or yellow and red) spots.....52.
46. Metathorax black without much ferruginous; scutellum and
postscutellum yellow; apical plate of abdomen entire; flies
in August (N. M.)..... **xanthophila** Ckll.
Metathorax with more red; scutellum red, postscutellum
yellowish; size smaller; apical plate of abdomen deeply
notched (Colo.)..... **libata** Cress.
47. Size larger; tegulæ yellow; apical plate of ♂ abdomen en-
tire (Colo., Wyo.)..... **superba** Cress.
Size much smaller.....48.
48. Tegulæ yellow (Colo.)..... **luteopicta** Ckll.
Tegulæ ferruginous.....49.
49. Head and thorax with much red; larger; flies in spring; ♀ (N.
M.)..... **placitensis** Ckll.
Head and thorax without red; smaller; apical plate of abdo-
men notched; ♂s.....50.
50. Antennæ very long, denticulate beneath; fourth joint very
long, at least twice as long as third on upper side (N. M.,
Colo.)..... **fragilis** Cress.
Antennæ not so long, not denticulate beneath; fourth joint
not nearly twice length of third on upper side (Colo.) **pallidella** Ckll.
51. Supraclypeal mark present; metathorax with four reddish or
yellowish spots, two being on the enclosure (Mont.)... **elrodi** Ckll.
Supraclypeal mark absent; metathorax with two small oval
yellow spots (Colo.)..... **gillettei** Ckll.
52. Basal nervure meeting transverse-medial or falling short of
it; species (at least **vincta** and **zebrata**) flying in late summer
and early fall.....53.
Basal nervure beginning decidedly (often greatly) basad of
transverse-medial.....54.
53. Apical plate of ♂ abdomen entire; mesothorax of ♂ wholly
black, or with very narrow reddish lateral margins, of ♀
black or red and black (Colo.)..... **vincta** Say.
Apical plate of ♂ abdomen slightly notched; mesothorax of
♂ with yellow lateral margins, of ♀ red (Colo., N. M.) **zebrata** Cress.
♂ unknown; mesothorax of ♀ black with yellow lateral mar-
gins; thorax narrower than in **zebrata**; yellow of metathorax
intruding on enclosure (which is not the case in **vincta** or
zebrata); third antennal joint considerably shorter than
fourth (it is considerably longer than fourth in **zebrata** and
vincta) (Colo.)..... **perivincta** Ckll.
54. Mesothorax black, with the anterior lateral corners red; api-
cal plate of abdomen truncate, not appreciably emargin-
ate; sides of metathoracic enclosure yellowish; ♂ (Colo.)
..... **agnia** Ckll.
Mesothorax red, with or without a black band; ♀s55.
55. Flagellum strongly blackened at end, mesothorax with a
broad median black band; scutellum yellow without a
median dark stripe or shade; basal nervure a short dis-
tance basad of transverse-medial; third antennal joint a
little shorter than fourth (Colo.)..... **perivincta** var. **semirufula** Ckll.
Flagellum red, not blackened at end.....56.
56. Ventral surface of abdomen yellow, with narrow red bands;
scutellum at least mostly yellow.....57.

- Ventral surface of abdomen red banded with yellow; third antennal joint shorter than fourth.....58.
57. Third antennal joint long; fourth considerably longer than fifth (Colo.).....*morrisoni* var. *flagellaris* Ckll.
- Third antennal joint shorter; fourth scarcely longer than fifth (Colo.).....*morrisoni* Cress.
58. Scutellum prominent, entirely red; tegulae strongly punctured; third antennal joint much shorter than fourth (Colo.).....*rhodoxantha* Ckll.
- Scutellum not prominent, with a yellow band at base; tegulae smooth and shining; third antennal joint a little shorter than fourth (Colo.).....*dilucida* Cress.
59. Markings white or cream-color.....60.
- Markings yellow.....62.
60. Ferruginous species; third antennal joint much longer than fourth (N. M.).....*gutierreziae* Ckll.
- Black or red and black species.....61.
61. Scutellum black with two cream-colored spots; head and thorax without red; third antennal joint slightly longer than fourth; ♂ (N. M.).....*aquilarum* Ckll.
- Scutellum ferruginous; thorax with much red in both sexes, third antennal joint much shorter than fourth (Colo.).....*accepta* Cress.
62. ♂s; head and thorax black.....63.
- ♀s; head and thorax red, usually marked with black.....64.
63. Smaller, length not over 8 mm.; scutellum black; upper half of clypeus black (N. M.).....*beulahensis* Ckll.
- Larger, length 10 mm.; scutellum red; clypeus yellow (Colo.).....*vicinalis* Cress.
64. Tubercles and postscutellum yellow; venter of abdomen largely yellow (Colo.).....*alpha* Ckll.
- Tubercles and postscutellum red; venter of abdomen red without yellow.....65.
65. Front marked with black; a black stripe on mesothorax; apex of flagellum fuscous; second abdominal segment with yellow lateral spots, third and fourth with bands (Colo.).....*libata* Cress.
- Front wholly red; no black stripe on mesothorax; flagellum wholly red; second and third abdominal segments with large wedge-shaped yellow marks, fourth with a band interrupted on each side (Colo.).....*coloradensis* Ckll.
66. Head and thorax black, abdomen black and rufous.....67.
- Head red marked with black; thorax black, a large mark on each side of mesothorax, the scutellums and most of pleura, red; clypeus yellow; abdomen without yellow; ♂ (Colo.).....*adducta* Cress.
- Head and thorax red; clypeus red.....68.
67. Clypeus reddish; legs rufous; basal nervure a short distance basad of transverse-medial; third antennal joint a little longer than fourth (N. M.).....*pennigera* Ckll.
- Clypeus black; legs black (N. M.).....*sidæifloris* (Ckll.)
68. Larger, about 7 or 8 mm. long; second abdominal segment with yellow spots.....69.
- Smaller, about 6 mm. long.....71.
69. Lower anterior orbits very narrowly yellow; third antennal joint very much shorter than fourth (N. M.).....*taraxacella* (Ckll.)
- Lower anterior orbits not yellow.....70.
70. Fourth and fifth abdominal segments with yellow bands, not nearly reaching lateral margins; third antennal joint nearly as long as fourth (Colo.).....*luteopicta* Ckll.
- Fourth and fifth abdominal segments without yellow bands; third antennal joint much shorter than fourth (Colo.).....*sayi* Rob.
71. Abdomen red without yellow spots; scape stouter and lighter; metathorax without a black band (Colo.).....*rhodosomella* (Ckll.)

Abdomen with spots; scape darker and more slender; meta-thorax with a black band (Colo.) *coloradella* Ckll.

In addition to the species recorded in the table, *Nomada* (*Micronomada*) *putnami*, Cress., *N. (Holonomada)* *affabilis*, Cress., *N. (Xanthidium)* *citrina*, Cress., and *N. (Nomada* s. str.) *pygmaea*, Cress., have been recorded from Colorado, but the records appear to require confirmation. The first three are indicated in comparison with Rocky Mountain species in tables in Proc. Acad. Nat. Sci. Phila., 1903, pp. 581, 582 and 609. For *N. affabilis* also see Robertson, Canadian Entomologist, 1903, p. 177. *N. pygmaea* (σ) is about six mm. long, mandibles simple; clypeus, a spot above it, labrum, mandibles and face narrowly on each side of clypeus, yellow; orbits ferruginous; abdomen granular.

DESCRIPTIONS AND NOTES.

Nomada (*Gnathias*) *lepida*, Cresson.

Evidently very common at Fort Collins, Colorado, numerous specimens of both sexes sent by Prof. Gillette. The dates are from May 8 to 17.

The insect which I described (Proc. Acad. Nat. Sci. Phila., 1903 p. 600) as the probable φ of *N. schwarzi*, is really the φ of *lepida*.

Nomada (*Gnathias*) *cuneata*, (Robertson).

A σ (sent by Prof. Gillette) was collected at Fort Collins, foothills, May 10, 1900, by E. S. G. Titus. Others seem intermediate between *lepida* and *cuneata*, and I rather expect that it will become necessary to regard the latter as a subspecies of *lepida*. At the same time, numerous eastern specimens of *cuneata* show no intergradation with *lepida*. It is perhaps a case like that of the bird-geese *Colaptes*.

Nomada (*Gnathias*) *albofasciata*, Smith.

Two σ s (sent by Prof. Gillette); one Fort Collins, foothills, April 24, 1900, by Titus; the others "Colo. 158r" taken at Fort Collins, foothills, May 6, 1904, by C. F. Baker.

Nomada (*Gnathias*) *belia*, Cresson.

A Colorado φ without locality label (sent by Prof. Gillette).

Nomada (*Gnathias*) *rubrella*, new species.

σ ; length hardly 7 mm.; closely allied to *N. schwarzi*, but differing as follows: Smaller; light markings creamy-white instead of yellow; sides of front narrowly, sides of vertex broadly (and enclosing a yellow spot), a band behind ocelli, and posterior orbital margins ferruginous; mesothorax dark ferruginous with a median black stripe; most of pleura ferruginous; metathorax (all black in *schwarzi*) ferruginous with an elongate black mark; middle femora with a little more than the basal third black behind, the black very sharply defined from the red; tegulae smaller and yellower; first abdominal segment (black right across at base in *schwarzi*) with very little black, only forming lateral hook-shaped marks; apical portion of abdomen not blackish; apical plate much less strongly notched. In both there is a yellowish mark at the apex of the abdomen beneath.

Habitat. Fort Collins, Colorado, May 18, 1901, near foothills, taken by Mrs. Laura Titus from plum blossoms.

Nomada (*Nomadula*) *americana* variety *saestana*, Cockerell.

σ , φ (sent by Prof. Gillette); the φ s are not distinguishable from true *americana*. Fort Collins, Colorado, May 28 and June

17. Also Colorado 2562 (Fort Collins, June 11, 1893, C. P. Gillette, collector), 1170 (Fort Collins, June 13, 1893, C. P. Gillette, collector) and 623 (Fort Collins, July 5, 1903, C. P. Gillette, collector).

***Nomada (Nomadula) martinella*, Cockerell.**

Three ♀s (sent by Prof. Gillette) are variable, and do not support the idea that the Colorado form is distinct from that of New Mexico. Two are from Fort Collins, May 28 and June 19; the other is marked Colorado 2521 (Fort Collins, May 28, 1897, E. S. G. Titus, collector).

The ♂ of *N. martinella* has not been described, but I find three specimens in the Colorado collection. They are closely allied to *N. scita*, but are readily separated by the broader abdomen and darker legs; the tegulae are bright lemon yellow with a hyaline spot; the thorax is covered with coarse hair which has a decided brownish tint. The scape is more swollen than in *scita*, and the yellow of the face is darker and stronger. The hind femora are stout with the lower edge decidedly concave. The scutellum is black. These ♂s are marked Fort Collins, May 20 and 21, and Colorado 2521.

***Nomada (Micronomada) vegana*, (Cockerell).**

This was described as a variety of *N. modesta*, but it seems to be a distinct though closely allied species. The ♂s are like true *modesta*, but uniformly small. Prof. Gillette sends five ♀s and two ♂s. They are mostly from Fort Collins, July 4 to 20; one is marked Colorado 1204 (Fort Collins, June 26, 1893, attracted to Helianthus leaves by their secretions.—C. F. Baker, collector).

***Nomada (Micronomada) vegana* variety *nifescens*, new variety.**

♀, just like *vegana*, except that the mesothorax, instead of being very closely punctured, has large irregularly scattered punctures on a shining ground. The ground-color of the first abdominal segment is red, and there is a red supra-clypeal mark. Perhaps a distinct species.

Fort Collins, Colorado, August 8, 1899 (E. S. G. Titus, collector).

***Nomada (Micronomada) lamarensis*, new species.**

♂, length about 9½ mm.: red, yellow and black. Markings bright lemon yellow, the pattern as in *N. vegana*, except that the mark on the pleura is narrower, the marks on the metathorax are wholly absent, and the band on the second abdominal segment is extremely broad; the ground-color of the body is dark red, becoming black on the vertex, the anterior part of mesothorax, and the enclosure of metathorax, and almost black on the pleura below the yellow band; the fourth abdominal segment is black anteriorly to the rather narrow yellow band, and the fourth ventral segment is black with two transverse reddish stripes, one on each side. The insect is much more robust than *vegana* (in build similar to *wheeleri*), and the head and thorax are very coarsely punctured; the punctures of the mesothorax are extremely large, and many of them confluent. Those of the pleura also very large. Sides of vertex with the

punctures very irregular, but leaving a good deal of shining surface; antennæ red, third joint longer than fourth, flagellum blackish above; tegulæ yellow with a ferruginous spot and rim; wings dusky, the apex very dark; stigma orange-ferruginous; nervures fuscous; second submarginal cell large and nearly square, receiving the recurrent nervure just beyond the middle; basal nervure meeting transverse-medial; ventral surface of abdomen without yellow markings; legs red, hind coxæ with a yellow spot, hind tibiæ with some yellow; anterior coxæ with red spines. Apical plate deeply notched.

One from Lamar, Colorado, June 17, 1900, (E. D. Ball, collector). This cannot be the ♂ of *N. wheeleri*, as that species has the submarginal cells quite different; in *wheeleri* the third submarginal cell is at least as broad above as the second, in *lamarensis* the second is rather more than twice as broad above as the third. The wings are much darker in *lamarensis* than in *wheeleri*. *N. lamarensis* resembles *N. crassula* in the very coarsely punctured mesothorax, and also in build, but differs in its red color, more strongly (indeed very strongly) bilobed scutellum, presence of a supraclipeal mark, etc.

***Nomada (Micronomada) uhleri*, new species.**

♂; length about 7½ mm.; similar to *N. vegana* but more robust, the abdomen of spherical form, after the manner of *N. erigeronis*; markings light primrose-yellow (deep yellow in *vegana*), similar to those of *vegana*, but the labrum is entirely light red, the scape has only a yellow shade, and the metathorax is wholly without yellow marks; the mesothorax is densely punctured, more densely and coarsely than in *vegana*; ground-color of head and thorax black, but middle of mandibles red, a small red spot beneath the wings, and a red patch above middle and hind coxæ; antennæ red, scape and basal part of flagellum blackened above, the black not ending abruptly; tegulæ primrose-yellow, with hyaline spot and margins; wings clear, with very dark apex; stigma ferruginous, nervures piceous, second marginal cell nearly square, and receiving the recurrent nervure very near the middle; in one wing of the type the first recurrent nervure is divided at the end, forming an areolet under the second submarginal cell; basal nervure meeting transverse-medial, and third antennal joint longer than fourth, as usual in *Micronomada*; spines on anterior coxæ red and very long; legs red, anterior tibiæ with a light yellow stripe in front, hind coxæ with a yellow mark; there is a yellowish spot at the apex of each femur, and at the end of the hind tibia; abdomen dark brown above, clear red on first segment, beneath dark ferruginous, with linear yellowish markings; above, the first segment shows a broad primrose-yellow band, the second an extremely broad band, narrower in the middle, and the others bands which are hidden by the retraction of the segments; apical plate strongly notched.

One from Fort Collins, Colorado, August 18, 1900, (E. S. G. Titus, collector). Named after Dr. Uhler, who was one of the first to collect species of *Nomada* in Colorado.

***Nomada (Holonomada) grandis*, Cresson.**

One marked Colorado 2509, taken in the foothills near Fort Collins, May 26, by C. P. Gillette. This differs from *N. magnifica* in the venation, but otherwise they are practically the same. I do not know whether the differential character, which in the case of *Gnathias* is certainly subgeneric, can here be only varietal.

Nomada (Holonomada) pecosensis, (Cockerell).

A ♂ from Palisades, Colorado, May 7, 1901, from apple bloom, (C. P. Gillette collector). It differs from the ♀ in having the pleura with a comparatively small yellow mark, and no yellow spot in front of anterior ocellus; the abdomen also is more inclined to be punctured. The species is the Rocky Mountain representative of *N. edwardsii*, from which it is easily known by the red color on the legs. Except as to the abdomen, the ♂ *N. pecosensis* agrees with the description of *N. intercepta*, Smith, from Vancouver I., which is evidently a *Holonomada*.

Nomada (Holonomada) vincta, Say.

Perfectly genuine *vincta*, one of each sex, were taken by F. C. Bishopp, at Fort Collins, Colorado, September 4 and 12, 1903, from sunflowers. (*Helianthus* sp.)

Nomada (Holonomada) zebata, Cresson.

A ♀ collected by E. S. G. Titus at Fort Collins, July 28, 1900. When we consider *N. zebata*, *vincta*, *morrisoni*, etc., the distinctions between *Holonomada* and *Xanthidium* appear to completely break down. *Holonomada* might possibly be restricted to *superba*, *edwardsii*, *pecosensis*, and their immediate allies; if this is not done, *Xanthidium* must I think be given up.

Nomada civilis, Cresson.

Three ♂s; Fort Collins, May 12, 1901, from plum blossoms; (E. S. G. Titus, collector) and one Denver, May 2, 1902.

Nomada (Xanthidium) rhodoxantha, new species.

♀; length about 10 mm., head and thorax ferruginous, strongly and closely punctured; scutellum prominent, bilobed; antennæ long, entirely red, third joint much shorter than fourth, flagellum stout; labrum with a minute denticle; extreme lower corners of face yellow, but no yellow on clypeus or mandibles; upper border of prothorax with a yellow stripe; tubercles and tegulae ferruginous, the latter strongly punctured; pleura with an obscure yellow spot posteriorly; metathorax with a median black band, on each side of which is a large area (including the sides of the enclosure) variegated with red and yellow; legs red, middle femora at base beneath, and hind femora largely blackish; wings clear with a brownish stain along the nervures, tips dusky; stigma bright ferruginous, nervures brown; second submarginal cell broad above, third greatly narrowed above, its outer margin strongly angled; basal nervure a short distance basad of transverse medial; abdomen minutely rugulose, ferruginous, with broad entire yellow bands on all the segments, basal half of first segment black; venter ferruginous, marked with yellow. The mesothorax has a strongly marked median black band.

One specimen, Colorado, without other locality label.

This has the general appearance of *N. morrisoni*, *luteoloides*, etc. From *luteoloides* it is easily known by the ferruginous, densely punctured (minutely cancellate) scutellum. From *morrisoni* it differs by the much narrower mesothorax, with larger and much more distinct punctures; the shape of the third submarginal cell, etc. From *placitensis* it differs by the much longer fourth antennal joint, the absence of the conspicuous brown hair on vertex and dorsum of thorax, etc. A form of

N. rhodozantha differing in some slight details of color, has been taken by Dr. Graenicher at Milwaukee, Wisconsin, on June 3.

***Nomada (Xanthidium) crawfordi*, new species.**

♀; length about 11 mm., another red species with entire and broad bright yellow bands on the abdomen, similar to the last, but the first segment has a round yellow spot on each side, instead of a band. The sides of the face broadly, the anterior edge of the clypeus, the labrum, the upper margin of prothorax, the tubercles, two spots on the tegulae, and four spots on the metathorax, are yellow. The ventral surface of the abdomen is mainly yellow beyond the first segment. The scape is suffused with yellow in front, the flagellum is strongly blackish above towards the end, but the extreme tip is red; the third antennal joint is a little shorter than the fourth; the second submarginal cell is broad above, the third much narrowed above, its outer margin strongly angled; the basal nervure is a short distance basad of the transverso-medial.

It is distinguished from the various similar species thus:

From *N. dilucida* by the mesothorax being entirely red except the narrow anterior border and the median band, which are black; by the scutellum being entirely red; by the metathorax having four yellow spots; by the strongly punctured tegulae; by the hind femora having a longitudinal red mark clean-cut out of the blackish at the base behind; by the hind tibiae being entirely red, but the basal joint of the hind tarsi yellow behind; and by the first abdominal segment being red, with a yellow spot on each side between two black spots. From *N. rhodozantha* by the broader form, longer third antennal joint, duskier wings, and quite different pattern of first abdominal segment. From *N. morrisoni* by the longer fourth antennal joint, peculiar color of flagellum, red scutellum, shape of third submarginal cell, etc. From *N. placitensis* by its larger size, yellow on face, much less black on thorax, etc. From *N. zebra* by the proportions of the antennal joints, red scutellum, etc. From *N. citrina* v. *rufula* by the red pleura and scutellum, the color of the flagellum, the absence of a yellow spot at the apex of the posterior femora, etc. The yellow of the legs is practically confined to the hind tarsi and front knees.

One specimen; Virginia Dale, Colorado, June 20, 1901, F. C. Bishopp, collector. *N. crawfordi* is named after Mr. J. C. Crawford, Jr., in recognition of his work on bees.

***Nomada (Xanthidium) collinsiana*, new species.**

Two ♂s taken by S. A. Johnson, Fort Collins, Colorado, May 11 and 20, 1903. One from wild plum. I had at first considered this a variety of *N. crawfordi*, but it may be kept separate for the present, at any rate. It differs from *crawfordi* thus: A trifle smaller; no yellow whatever on head or thorax; middle of front black, with a red spot in front of anterior ocellus; flagellum red; apical part not blackened; thorax more hairy; tegulae entirely red; third submarginal cell nearly or not far from as broad above as second; basal nervure more basad of transverso-medial; legs without yellow, except a small obscure spot at base of anterior and middle tibiae; hind femora red, with a broad black stripe behind, not reaching either end, and on it a band of short yellowish hair; hind coxae with much black (only a little in *crawfordi*); base and apical margin of first abdominal segment black; pygidial plate narrower, venter ferruginous marked with yellow and black.

Nomada (Xanthidium) perivincta, new species.

A ♀ marked Colorado, without definite locality.

Length 10½ mm.; ground-color of head and thorax black; labrum yellow, with a small reddish spine; mandibles pale ferruginous, with black tips; face below antennæ yellow; the upper part of clypeus, and upper part of supraclypeal area, ferruginous; front with ferruginous bands continued from the lateral face marks, strongly curving inwards; a red spot before middle ocellus; posterior orbital margins rather broadly red; scape ferruginous behind, bright yellow in front; flagellum ferruginous, the last six joints strongly blackened, the extreme apex red; fourth antennal joint much longer than third; mesothorax very coarsely and densely rugoso-punctate, its lateral margins yellow edged with ferruginous; upper border of prothorax, tubercles, scutellum, a spot at each anterior corner, postscutellum, and large quadrate marks on metathorax encroaching on enclosure, all bright yellow; pleura yellow, with a small black and red mark above, and a large black mark surrounded by red below; legs a lively red; hind coxæ with a large black mark behind and a yellow one above; anterior femora yellow in front and apically, middle femora with less yellow in front, but a large mark at apex, hind femora with a yellow stripe in front and a large black area behind; tibiæ yellow on outer side, hind tibiæ with a black stripe behind; basal joint of hind tarsi mainly yellow; tegulæ shining and sparsely punctured, ferruginous with a yellow spot in front; wings rather yellowish, apex clouded; stigma bright ferruginous, nervures brown; second submarginal cell very broad above, not far from square, receiving the recurrent nervure well beyond its middle; third a little broader below than second, but very greatly narrowed above, its outer margin strongly angled; basal nervure meeting transverso-medial; abdomen minutely rugulose, bright yellow, with the base of first segment, and three broad bands at the junction of the segments, black; hind margin of fourth segment reddish brown, fifth all yellow; venter yellow (reddish on sides of first segment) with three black bands on which are reddish stripes.

N. perivincta differs from *N. vincta* by the considerably larger punctures of the mesothorax, the color of the hind legs, the yellow of metathorax intruding on enclosure, the proportions of the antennal joints, etc. From *N. citrina* it differs by the narrower face, the broad third submarginal cell, etc. From *N. citrina* v. *rufula* by the narrower face, the blackened apical part of flagellum, etc. From *N. rhodoxantha* by the yellow scutellum, color of legs, etc. From *N. sulphurata* by the much narrower first segment of abdomen, broad third submarginal cell, etc. From *N. rivalis* by the markings of thorax and legs, etc.

Nomada perivincta variety **semirufula**, new variety.

A ♀ marked Colorado, without definite locality.

Mesothorax mainly dark red, with a broad median black band, and a good deal of black on the anterior and posterior margins; anterior lateral corners only yellow. Lower part of pleura with a large red patch without black; yellow marks on metathorax margined with red; first abdominal segment considerably broader, its basal half red with a blackish transverse band; venter with black bands only on the first and extreme base of fourth segments. This resembles *N. sulphurata* in the darkened apical part of flagellum, etc., but the first abdominal segment though broader than in the type, is by no means so broad as in *sulphurata*, while the colors of the mesothorax and ventral surface of abdomen, and the shape of the third submarginal cell, are quite different. The basal nervure in

semirufula begins well basad of the transverso-medial, as in *sulphurata* and not as in *perivincta*.

***Nomada gillettei*, new species.**

Named after Professor Gillette, who has done so much for Colorado entomology. The type is a ♂ marked Colorado 2198. Taken at Golden, July 3rd, by C. P. Gillette.

Length 9½ mm.; head and thorax black, densely and coarsely punctured; facial quadrangle considerably broader than long; front concave; labrum, basal half of mandibles, clypeus, very broad lateral face marks ending at level of antennæ, and broad marks beneath eyes, all chrome yellow; antennæ lively ferruginous, fourth joint much longer than third; scape quite swollen, yellow in front, and with a black dash and dot behind; hair of head and thorax scanty, white; upper border of prothorax, tubercles, V-shaped mark beneath, and a spot on each side of the lower part of metathorax, all yellow; scutellum with two minute red spots; legs a lively red, extreme base of anterior and middle tibiæ with an obscure yellowish spot; middle femora with a small black spot at extreme base; hind femora nearly all black behind; tegulæ punctured, whitish tinged with red; wings clear, yellowish along the nervures; stigma and nervures ferruginous; second submarginal cell broad above, receiving the recurrent nervure a little beyond its middle; third at least as broad as second below, but narrowed more than half above, its outer margin bent; basal nervure a short distance basad of transverso-medial; abdomen yellow, the bases of the segments black, their apical margins pale ferruginous; the yellow band on the first segment is interrupted in the middle by a reddish triangle pointing posteriorly; apical plate narrow, feebly notched; venter yellow, banded with dark reddish brown. The face is bare, without the beautiful appressed white hair seen in *N. elrodi*. The colors of the abdomen recall *N. civilis*.

***Nomada agynia*, new species.**

One ♂ sent by Prof. Gillette, marked Colorado 2196, Golden, July, C. P. Gillette, collector.

Length about 9 mm.: black with yellow markings; head broad, facial quadrangle about square; basal two-thirds of mandibles, labrum, clypeus, lateral face-marks (broad below, gradually narrowing to a point at top of eyes) and posterior orbits nearly to summit, all yellow; clypeus with the usual sutural black spots; supraclypeal mark obscure reddish, narrowly surrounded by black; antennæ not very long, third joint much shorter than fourth; scape stout, heavily marked with black on a red field above, yellow below (in front); flagellum dark ferruginous, blackish above, especially towards base; mesothorax dull, very densely and quite coarsely ragoso-punctate, the anterior lateral corners, and a few marks on lateral margin, red; upper border of prothorax, tubercles, scutellum and postscutellum, yellow; pleura red with a broad curved transverse yellow band, and a large black spot beneath; metathorax black in the middle, the sides (encroaching on the enclosure) variegated with red and yellow; tegulæ yellow, large, shining and rather sparsely punctured; wings quite long, hyaline, the apex blackened; stigma ferruginous, nervures fuscous; second submarginal cell broad below, but narrowed above; third broad below, and narrowed more than half above; basal nervure a short distance basad of transverso-medial; legs lively ferruginous, the hind femora and tibiæ darker, the hind femora black behind except at base and apex; middle femora somewhat swollen, with a blackish spot on apical half behind; knees, and a stripe on anterior tibiæ, yellow; abdomen rather broad, closely and minutely punctured; all the segments yellow with black bases and ferruginous apical margins, the yellow of the

first segment with a pair of small reddish sublateral marks; apical plate narrow, truncate, with the faintest suggestion of an emargination; venter yellow with blackish and reddish bands.

This is possibly the ♂ of some described species, but after repeated comparisons, I cannot satisfactorily assign it to any. In my table in Proc. Acad. Nat. Sci. Phila., 1903, p. 559, it runs to *pascoensis*, which it superficially resembles, but it is easily known from that by the quite ordinary last antennal joint, the light marks on metathorax, etc.

***Nomada pallidella*, new species.**

One ♂ marked Colorado 566 (Montrose, June 24, 1902, C. P. Gillette, collector).

Length about 7½ mm.; black, marked with pale yellow; quite hairy. Facial quadrangle about square: labrum, mandibles except tips, narrow stripe beneath eyes, clypeus and lateral face-marks, yellow, lateral face-marks reduced to a triangle at lower corners of face, which sends a line upwards along orbital margin nearly to level of antennæ; antennæ long, scape ordinary, yellow in front; third joint much shorter than fourth; flagellum dark ferruginous, blackened above; mesothorax dull and very densely rugoso-punctate; tubercles, a small mark on anterior part of pleura, and two spots on scutellum, yellow or yellowish tinged with reddish; metathorax entirely black; hair of dorsum of thorax brownish; tegulæ ferruginous, punctured; wings iridescent, dusky at tips; stigma ferruginous, nervures fuscous; second submarginal cell broad above, third greatly narrowed above; basal nervure meeting transverso-medial, but a little on the basal side; legs red without any yellow; basal half of anterior femora behind, most of basal two-thirds of middle femora behind and beneath, and all of the hind femora except apex, black; hind tibiæ with a blackish dash on inner side; abdomen minutely roughened; light yellow bands on segments two to six not interrupted, but those on four and five enclosing laterally a dark spot; band on first segment with a rather broad median ferruginous interruption, the area posterior to the band also being ferruginous, with two blackish dots; otherwise, the dark parts of the abdomen are black or almost so; apex with long hairs; apical plate quite broad, deeply notched; venter red-brown, with yellow bands bent in the middle and not reaching the lateral margins.

From Robertson's *N. salicis* and *N. simplex* (♂s) this is readily separated as follows:

Apex of abdomen strongly notched..... 1.

Apex of abdomen slightly notched; scutellum black..... *simplex*.

1. Legs marked with yellow..... *salicis*.

Legs not marked with yellow..... *pallidella*.

The Californian *N. subangusta*, Ckll., is very near to *N. pallidella*, but it has the first abdominal segment narrower; the abdomen, where not yellow, mainly red; the scutellum entirely black, the second submarginal cell narrower; and the red of the flagellum much brighter. In the face-marks, hairy thorax, etc., they agree.

From *N. modocorum*, Ckll., *N. pallidella* is easily known by the much narrower, parallel-sided abdomen, with much paler markings, those of *modocorum* being bright yellow.

***Nomada sayi*, Robertson.**

One ♀ collected by E. S. G. Titus at Virginia Dale, Colorado, July 24, 1899, from wild geranium. The date seems too late for *sayi*, and the specimen is hardly typical; it is not *N. lchighensis*, which flies in July. Probably when we have a good series of the Colorado insect, including both sexes, it will be possible to separate it subspecifically, at least.

Nomada coloradella, new species.

A pair; ♂, Fort Collins, Colorado, June 18, 1900; ♀, Colorado 633 (Dolores, June 18, '92, C. P. Gillette, collector).

♂; length 5½ mm.; head and thorax black, with abundant white hair; labrum, mandibles except tips, clypeus and lateral face-marks, bright yellow; lateral face-marks consisting of triangles occupying the lower corners of face, sending a line upwards to level of antennæ; facial quadrangle somewhat broader than long; antennæ very long; scape moderately stout, yellow in front and black behind; third joint much shorter than fourth; flagellum submoniliform, pointed at apex, bright light yellowish-ferruginous, the first four joints black above; tubercles and tegulæ reddish-testaceous, scutellum with two reddish spots, thorax otherwise all black; wings clear, dusky at apex; nervures and stigma yellowish-ferruginous, marginal cell long; second submarginal broad above, receiving the recurrent nervure far beyond its middle; third submarginal very broad below, greatly narrowed above, its outer margin strongly bent; basal nervure meeting transverso-medial (in *N. sayi* it is a long distance basad of it); legs red, the femora blackened behind and beneath; abdomen ferruginous, basal half of first segment black; a bright yellow band, interrupted in the middle, on segments 2 and 3; yellow hardly apparent on 4, but prominent on 5 and 6; apex with long hairs; apical plate moderately notched; venter ferruginous.

♀; length about 6 mm., red, mesothorax and metathorax each with a single black band; ocelli on a black patch, but front all red; antennæ red, scape with a blackish apical spot on inner side; third antennal joint about as long as fourth; first segment of abdomen practically without black; basal nervure meeting transverso-medial, but on the basad side. The ♂ is to be regarded as the type; it is not quite certain that the ♀ belongs to it, but it is probable enough to justify the association for the present. The ♂, in its color and markings, is like *N. sayi*, but it is easily distinguished by the venation. It differs from *N. rhodosoma* by its smaller size and much lighter antennæ and stigma; from *N. oregonica* by its light orange stigma, and apical half of flagellum not black above; from *N. lehighensis* by its smaller size, and quite different color of antennæ and stigma; from *N. pygmæa* by the absence of supraclypeal mark, and orbits not ferruginous. It is also allied to *N. illinoensis*. The ♀ resembles *N. rhodosomella*, but is separated by the characters given in the table.

Nomada luteopicta, new species.

Two ♂s and a ♀ collected by Prof. Gillette; all Palisades, Colorado, May 7, 1901, from apple blossoms.

♂; length about 6½ mm.; head and thorax black, with abundant white hair; labrum, mandibles except tips, narrow stripe beneath eyes, clypeus and lateral face-marks (consisting of a triangle at lower corners of face, sending a line upwards to level of antennæ) all bright-yellow; eyes green; antennæ long, scape rather swollen, yellow in front and black behind; third joint shorter than fourth; fourth shorter than last; flagellum bright clear yellowish-ferruginous, the first four joints black above; tubercles, tegulæ, upper border of prothorax, mark on anterior part of pleura, and two clearly-defined oval spots on scutellum, yellow; wings slightly dusky, apex darker; stigma dark ferruginous, nervures fuscous; second submarginal cell very narrow, or broadened below by the lengthening of the lower basad corner, in which case the recurrent nervure is received much beyond its middle; third submarginal extremely broad below, narrowed more than half above, its outer side strongly bent; basal nervure meeting transverso-medial; legs red, middle and hind coxæ mainly black; middle femora with a black stripe beneath, hind femora mostly black behind; all the knees broadly, and apex of hind tibiæ, yellow; abdomen yellow, the segments ferruginous on apical margin, and more or less black basally; apex with long hairs, apical plate very feebly notched;

venter yellow, ferruginous at base, and with the hind margins of the segments broadly pale ferruginous.

♀; red; mesothorax and metathorax with a median black band; third antennal joint not greatly shorter than fourth; abdomen red, not black at base; second and third segments with a subquadrate bright yellow spot on each side, third also with a pair of yellow dots mesad of the spots, fourth with a yellow band, not reaching lateral margins, fifth with a short broad band; venter without yellow.

The ♂ is to be considered the type. It is closely allied to *N. coloradella*, but larger, with a broader abdomen, with much more yellow. The ♀ is very near to *N. lewisi*, Ckll., but has no yellow at lower corners of face; and has the third submarginal cell much broader. The scutellum of the ♀ is low and scarcely bilobed, as in *N. simplex*, Rob., which is closely allied; but *simplex* has much more black on the head and thorax, and the fourth abdominal segment spotted instead of banded.

Nomada coloradensis, Cockerell.

A pair; the ♂ marked Fort Collins, Colorado, foothills, May 19, 1900, E. S. G. Titus, collector; the ♀ marked Colorado 566, just like the original type. Taken June 24, 1892, at Montrose, by C. P. Gillette. At Milwaukee, Wisconsin, Dr. Graenicher has taken a form of *N. coloradensis*, which may prove to be subspecifically separable.

The ♂ has not been described. It is very similar to several ♂s, from which it is readily separated as follows:

- | | |
|--|--|
| Scape conspicuously swollen, apical plate broad | 1. |
| Scape ordinary; venter red not spotted with yellow; apical plate narrow | 3. |
| 1. Pleura with much red; metathorax with four red spots; venter with large yellow markings | <i>bethunei</i> Ckll. |
| Pleura and metathorax without red (or pleura with a small red mark) | 2. |
| 2. Venter spotted or banded with yellow | <i>vicinalis</i> Cresson. |
| Venter red without yellow. | <i>vicinalis</i> var. <i>infrarubens</i> Ckll. |
| 3. Larger; mesothorax marked with red; first abdominal segment with a yellow band | <i>armatella</i> Ckll. |
| Smaller; metathorax all black; first abdominal segment without a yellow band | <i>coloradensis</i> Ckll. |

I am greatly indebted to Mr Rehn for the information that Cresson's type of *N. vicinalis* has the apical plate of abdomen broad, scape normal, base of metathorax more granulose than rugulose, labrum with a very slight median denticle.

N. vicinalis infrarubens is a new variety obtained by Prof. Cordley at Corvallis, Oregon, June 6, 1899. It has the following noteworthy characters; labrum very hairy; ends of linear upward prolongation of lateral face-marks slightly bending from orbits; flagellum bright red, the last joint pointed, the first five joints black above; hair of upper part of thorax (especially scutellum) strongly brownish; tubercles reddish with a yellow spot; tegulae, scutellum, two stripes on mesothorax, and a small mark on lower part of pleura in front, red; first abdominal segment with basal half black, with two red marks; yellow bands on segments 1 to 5 broadly interrupted by red in the middle; sixth segment with a short bilobed yellow band; apical plate very hairy. The antennae remind one of *N. pascoensis*, but the insect is otherwise very different.

Nomada alpha, new species.

One ♀ taken by F. C. Bishopp, marked Fort Collins, May 20, 1903, Colorado. Taken from flowers of *Capsella bursa-pastoris*.

Length about 8½ mm.; head and thorax red, with black and yellow markings; abdomen red and yellow. Front depressed, coarsely an

closely punctured; facial quadrangle much broader than long; mandibles very shiny, pale reddish with black tips and more or less yellow bases; labrum, clypeus, and sides of face on each side of clypeus, yellow, the yellow not sharply defined from the red just above; ocelli on a black patch, connected with a black patch on front, but leaving a red mark in front of middle ocellus; frontal patch sending black bands to sides of clypeus, these and the narrowly blackened upper clypeal suture making a large A; posterior orbital margins very broadly red, with a large yellow stripe on the lower two-thirds; antennæ long, red without any black, scape yellowish in front; third joint longer than fourth; mesothorax coarsely rugoso-punctate, red with three rather ill-defined black stripes; prothorax black, with its upper border, and the tubercles, yellow; pleura red, with a black spot beneath; a broad black band from wings to middle and hind coxæ; scutellum red suffused with yellow; postscutellum bright yellow; metathorax black, with a large red spot on each side; tegulæ red; wings yellowish, apical margin not much darker than the rest; stigma bright orange-ferruginous, nervures pale brownish; second submarginal cell moderately narrowed above; third of the narrow type; basal nervure a long distance basad of transverso-medial; legs bright red, anterior and middle femora with more or less of a yellow apical spot; hind femora wholly without black; abdomen very minutely rugoso-punctate; first segment red with a transverse yellow mark on each side; second red with very large pyriform yellow marks; third similar, but with even more yellow; fourth yellow except extreme base and apical margin: fifth yellow; venter banded with yellow and red.

In Robertson's tables this runs to *Holonomada*, but it is closely related to some of the species which are referred to *Xanthidium*.

***Nomada libata*, Cresson.**

This is erroneously called *limbata* in Dalla Torre's Catalogue. Mr. Rehn has kindly examined Cresson's type ♂, and finds the apical plate rather narrow, deeply notched; the ventral surface of abdomen immaculate except the apical margins of the three terminal segments, which are yellow to a considerable degree; scape normal.

These characters are in part similar to those of *N. armatella*, which may be known from *libata* by the absence of yellow on venter and the basal nervure far basad of transverso-medial (in *N. libata*, *parata*, *bethunei* and *coloradensis* it is only a little basad of it).

***Nomada dilucida*, Cresson.**

Mr. Rehn has kindly examined Cresson's type ♀, and finds it differs structurally from *N. morrisoni* thus: labrum narrower, more rectangular; scape heavier and more robust; abdomen glabrous instead of pubescent.

I am extremely indebted to Mr. Viereck, who has most kindly examined all of the types in the collection at Philadelphia, and reported on the venation and proportions of the third and fourth antennal joints.

***Nomada frieseana*, Cockerell and *N. semiscita*, Cockerell.**

These two species were discovered at Colorado Springs since this paper was written, and described in *Annals & Mag. of Nat.-Hist.*, July 1904. *N. frieseana* is allied to *N. rubicunda*, and *N. semiscita* to *N. scitiformis*.